



POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

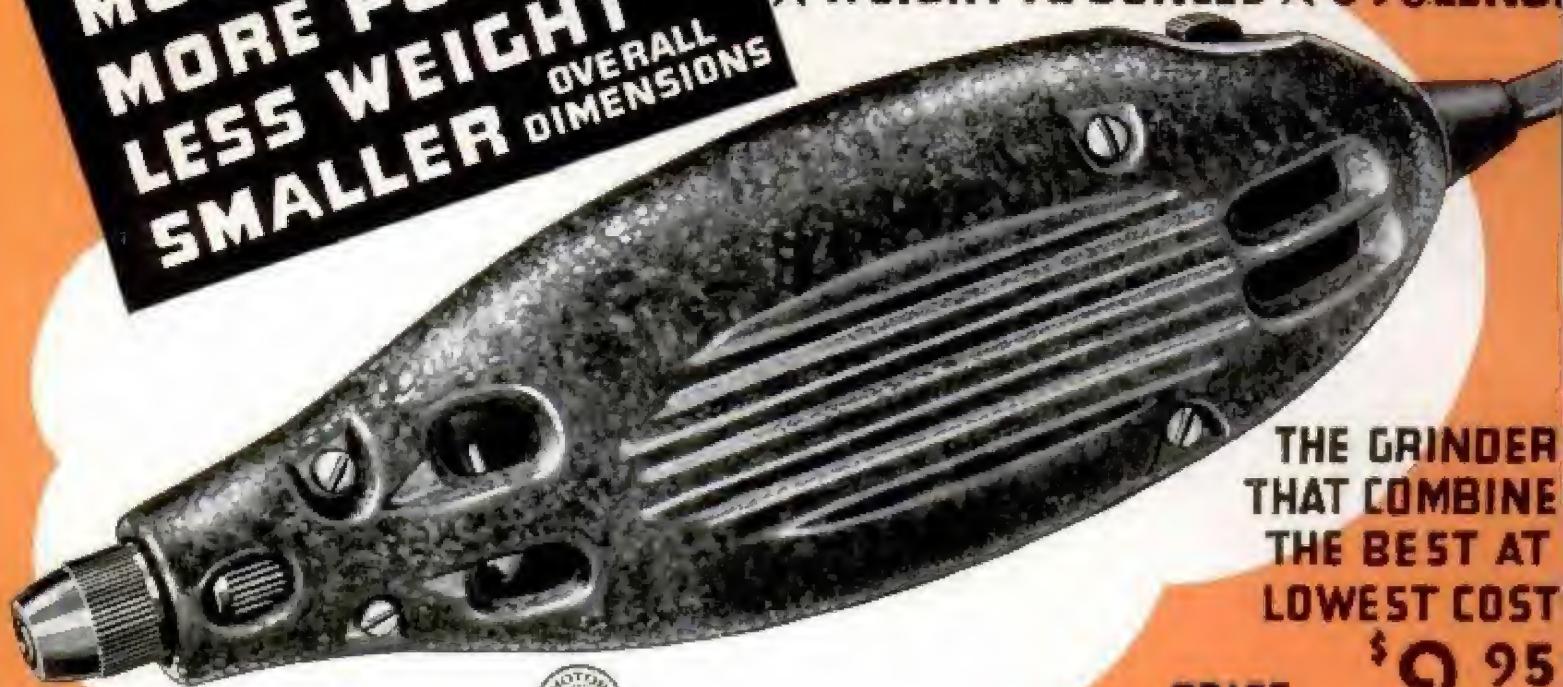
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SEE PAGE 246

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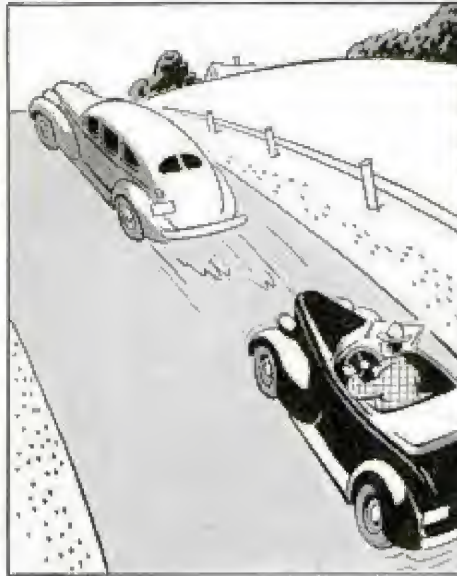
**HAND
GRINDER**

Are worn-out spark plug cables robbing you

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OF GOOD GAS MILEAGE?



When you neglect the wiring in your car, you are getting short-changed both in money and in driving enjoyment. Worn-out spark plug cables reduce engine performance and economy; undersize or corroded battery cables starve your starting motor and coil, causing hard starting; faulty lighting wires and connections can cause greatly reduced headlight candlepower; and improper accessory wiring can spoil the performance of your radio. In addition, the poor condition of a cable in one circuit can do real harm to the electrical units in other circuits, and hand you a big repair bill.

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A NATION UNITED BY TELEPHONE

Just twenty-five years ago, on January 25, 1915, the first transcontinental telephone call was made. East and West were united.

President Woodrow Wilson talked from the White House across the country, testifying to the nation's pride "that this vital cord should have been stretched across America as a sample of our energy and enterprise."

The inventor of the telephone, Alexander Graham

Bell, in New York, repeated across the continent to San Francisco the first words ever heard over a telephone—"Mr. Watson, come here, I want you"—to the same Thomas A. Watson who had heard them in the garret workshop in Boston in 1876.

That ceremony ushered in transcontinental service twenty-five years ago. At that time it cost \$20.70 to call San Francisco from New York. Now it costs \$6.50 for a

station-to-station call and only \$4.25 after seven in the evening and all day Sunday.

In 1915 it took about half an hour, on the average, to make a connection. Now most calls are put through without hanging up.

These are measures of progress in the never-ending effort of the Bell System to give faster, clearer, more useful and courteous service to the people of the United States.

BELL TELEPHONE SYSTEM



Say you saw it in Popular Mechanics!

Popular Mechanics Magazine

H. H. WINDSOR, Founder

H. H. WINDSOR, Jr., Editor and Publisher

February, 1940

Vol. 73, No. 2

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Destroyer Versus Submarine

SHARP eyes on the destroyer's bridge catch a glimpse of a foamy "V" in the water. "Periscope!" The commander barks a swift order to the helmsman and the ship fairly heels over as the wheel spins and the greyhound bears down on that tiny wake that betrays a submarine. Other destroyers in the convoy join the chase, sweeping in wide circles and dropping depth charges that explode violent fountains at the surface and jar the ship now hiding 200 feet down. An article in the March issue will take you to sea to watch the war between those natural enemies, the submarine and the destroyer.

New Metals from Powder

METALS that never would mix when molten are being mixed today into new alloys by a method that is revolutionizing metallurgy. It is the "squeeze" process. Finely powdered metals are molded into useful shapes under pressures as high as 100 tons to the square inch. Some of the amazing results of this new technique are described in the next issue.

Next Month

GLASS used to be simply that brittle, transparent stuff of which windows and goblets were made. Today you can buy neckties and draperies of silky glass, woolly bats of glass for insulation, vacuum walls of glass brick and "sandwich" glass that will stop a bullet. Youngest of the family is the tough-tempered glass that stops a bowling ball dead, yet flies into a thousand fragments at the impact of a tiny dart. Next month "The Age of Glass" is revealed in an eight-page Coloroto section.

Cliff-Dwelling Hens

FORTY million hens that never saw a barnyard are living happily in wire cages, not a care on their minds except the business of producing eggs to pay their board and room. Their keepers are mechanics and clerks, teachers and business men who have found there's something to the claim of agricultural schools that you can clear \$2.50 a year on every laying hen. A feature in March tells how city and town folk are making money with cliff-dwelling hens.

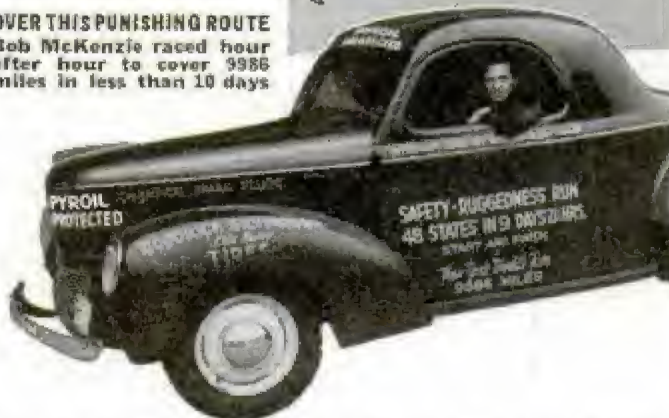
Air Corps Hornets

SKIMMING just above the earth at four miles a minute, three flights of attack planes converge, seconds apart, on an enemy hangar. A master trigger is pressed and four machine guns in the wings strafe the ground. Bombs drop, and the blast jars the low-flying attackers dangerously. The "Hornets of the Air Corps" take the most chances, you'll agree. Read their story in March.

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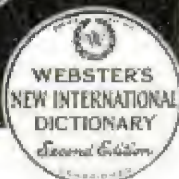
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WHERE DO YOU GO FROM HERE?

YOU'RE like a million other men—you're facing a big question. The depression turned business topsy-turvy and now the rebuilding period stares you in the face.

Are the things that are happening today going to help or hinder you—what will they mean in your pay check? Where will they put you five, ten, twenty years from now? How can you take full advantage of this period of opportunity?

We believe you will find the answer here—a suggestion the soundness of which can be proven to you as it has been to thousands of other men.

The whole trend today—legislation, spirit, action—is to put men back to work, raise earning and spending power, *give every man a fair chance to work out his own salvation.*

The road to success remains unchanged but, bear this in mind, *what it takes to win is radically different!*

No employer today would dare risk an important post in the hands of a man who had not learned the lesson of '29. Why should he, when right at this moment he can pick and choose and get almost any man he wants at his own price?

Business organizations are rebuilding—reorganizing for the new conditions. Before it is over every man and every method will be judged in the cold light of reason and experience—then dropped, remade or retained. This spells real opportunity for the man who can meet the test—but heaven help the man who still tries to meet today's problems from yesterday's standpoint! Out of the multitude still

jobless there are sure to be many frantically eager to prove him wrong and take his place.

Some Men Have Found the Answer

Seeing these danger signs, many aggressive men and women are quietly training at home—are wisely building themselves for more efficient service to their employers.

You naturally ask, "Has your training helped men withstand conditions of the last few years?"

Our answer is to point to a file of letters from many of our students reporting *pay raises and promotions while business was at its lowest ebb*—together with a myriad of others telling of greater success during these recent months of recovery.

Unusual evidence is ready for your investigation. We have assembled much of it in a booklet that is yours for the asking, along with a new and vitally interesting pamphlet on your business field.

This is a serious study of the possibilities and opportunities in that field. It is certain to contain an answer to vital questions bothering you today about your own work and earning power.

Send for these booklets—coupon brings them free. Be sure to check the LaSalle training that interests you most. We will tell you also how you can meet and take fullest advantage of today's situation. No cost or obligation—so why not mail the coupon now?

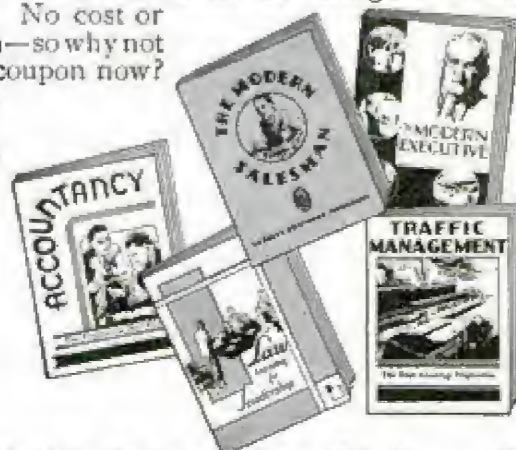
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3-IN-ONE Oil

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IMPORTANT NOTICE

It is the intention of this magazine to provide its readers with information regarding the latest developments in the mechanical arts. We take no responsibility as to whether the disclosures contained in our articles are covered by patents and advise readers to investigate this subject before making, using, or selling any of the products, machines, or processes described, in order to avoid possible liability for patent infringement.



"THE RUDDER'S GONE, SIR!"

● Fateful moment — when a ship loses its rudder! Then a great hulk drifts helplessly — and unless aid comes, that ship goes "on the rocks."

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| <input type="checkbox"/> Building Estimating | | <input type="checkbox"/> House Planning | <input type="checkbox"/> Practical Telephony | <input type="checkbox"/> Surveying and Mapping | |
| <input type="checkbox"/> Chemistry | | <input type="checkbox"/> Locomotive Engineer | <input type="checkbox"/> Public Works Engineering | <input type="checkbox"/> Telegraph Engineering | |
| <input type="checkbox"/> Civil Engineering | | <input type="checkbox"/> Machinist | <input type="checkbox"/> Radio, General | <input type="checkbox"/> Textile Designing | |
| <input type="checkbox"/> Coal Mining | | <input type="checkbox"/> Management of Inventors | <input type="checkbox"/> Radio Operating | <input type="checkbox"/> Toolmaking | |
| <input type="checkbox"/> Concrete Engineering | | <input type="checkbox"/> Managing Men at Work | <input type="checkbox"/> Radio Servicing | <input type="checkbox"/> Welding, Electric and Gas | |
| <input type="checkbox"/> Contracting and Building | | <input type="checkbox"/> Manufacture of Pulp Paper | <input type="checkbox"/> R. R. Section Foreman | <input type="checkbox"/> Woolen Manufacturing | |

BUSINESS COURSES

- | | | | | |
|--|--------------------------------------|--|---|---|
| <input type="checkbox"/> Accounting | <input type="checkbox"/> Advertising | <input type="checkbox"/> Civil Service | <input type="checkbox"/> First Year College | <input type="checkbox"/> Railway Postal Clerk |
| <input type="checkbox"/> Bookkeeping | | <input type="checkbox"/> College Preparatory | <input type="checkbox"/> Foremanship | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Business Correspondence | | <input type="checkbox"/> Commercial | <input type="checkbox"/> French | <input type="checkbox"/> Secretarial |
| <input type="checkbox"/> Business Management | | <input type="checkbox"/> Cost Accounting | <input type="checkbox"/> Grade School | <input type="checkbox"/> Service Station Salesmanship |
| <input type="checkbox"/> Cartooning | | <input type="checkbox"/> C. P. Accounting | <input type="checkbox"/> High School | <input type="checkbox"/> Sign Lettering |
| | | | <input type="checkbox"/> Illustrating | <input type="checkbox"/> Spanish |
| | | | <input type="checkbox"/> Lettering Show Cards | <input type="checkbox"/> Traffic Management |

DOMESTIC SCIENCE COURSES

- | | | |
|---|---|---|
| <input type="checkbox"/> Advanced Dressmaking | <input type="checkbox"/> Home Dressmaking | <input type="checkbox"/> Tea Room and Cafeteria |
| <input type="checkbox"/> Foods and Cookery | <input type="checkbox"/> Professional Dressmaking and Designing | <input type="checkbox"/> Management, Catering |

Name..... Age..... Address.....

City..... State..... Present Position.....

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YOU have undoubtedly heard of the U. S. School method of teaching music by mail. This remarkable system of instruction has been in operation for over forty years and more than 700,000 people in all parts of the world have enrolled for it. Men, women and children of all ages and from all walks of life have taken up their favorite musical instruments this convenient, money-saving way. They have studied the piano, violin, guitar, accordion and, in short, every kind of popular instrument.

No Special Talent Required

Many of these pupils did not know one musical note from another when they enrolled. Many had previously tried other methods of instruction without success. And not a few were frankly skeptical. They doubted whether it was possible to learn music by mail, just as you may doubt it.

To some of these "Doubting Thomases" it came as the surprise of their lives when they actually heard themselves playing. Simple, popular melodies at first, then more and more advanced pieces, all the way to Grand Opera.

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The experience of thousands upon thousands of people should be proof positive that you, too, can learn to play your favorite instrument by the famous print-and-picture method of the U. S. School of Music. Is it not a pity, then, to deny yourself all the enjoyment, the good times and popularity that music offers? Do you not owe it to yourself, at least, to examine all the facts, and to decide, once and for all, whether you can afford to pass by this opportunity to enrich your life with music?

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*Figures computed from Government report. For basis of computation, write American School.

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\$40 a week*
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income
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| <input type="checkbox"/> Aviation | <input type="checkbox"/> Radio and Television |
| <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Salesmanship |
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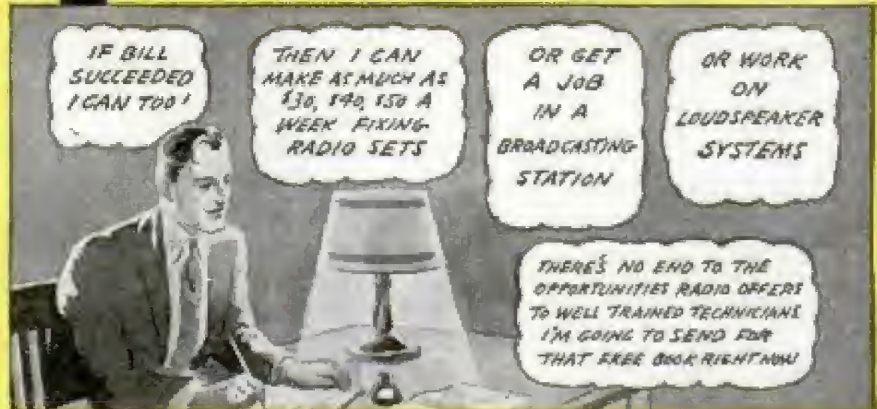
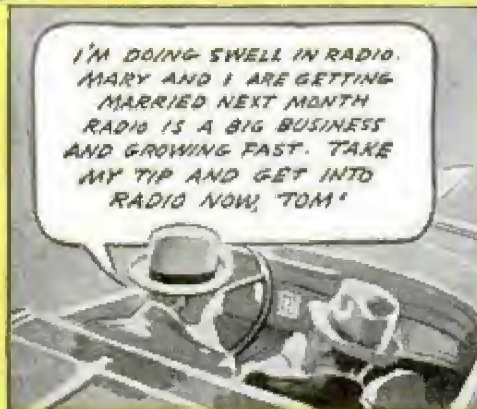
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for Good Jobs in Radio**

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Jobs Like These Go to Men Who Know Radio

Radio broadcasting stations employ engineers, operators, technicians and pay well for trained men. Radio manufacturers employ testers, inspectors, foremen, servicemen in good-pay jobs with opportunities for advancement. Radio jobbers and dealers employ installation and servicemen. Many Radio Technicians open their own Radio sales and repair businesses and make \$30, \$40, \$50 a week. Others hold their regular jobs and make \$5 to \$10 a week fixing Radios in spare time. Automobile, police, aviation, commercial Radio; loudspeaker systems, electronic devices, are newer fields offering good opportunities to qualified men. And my Course includes Television, which promises to open many jobs soon.

Why Many Radio Technicians Make \$30, \$40, \$50 a Week

Radio is already one of the country's large industries even though it is still young and growing. The arrival of Television, the use of Radio principles in industry, are but a few of many recent Radio developments. More than 28,000,000 homes have one or more Radios. There are more Radios than telephones. Every year millions of Radios get out of date and are replaced. Millions more need new

Get Facts About THIS



tubes, repairs, etc. Over 5,000,000 auto Radios are in use and thousands more are being sold every day. In every branch Radio is offering more opportunities—opportunities for which I give you the required knowledge of Radio at home in your spare time. Yes, the few hundred \$30, \$40, \$50 a week jobs of 20 years ago have grown to thousands.

Many Make \$5, \$10 a Week Extra In Spare Time While Learning

The day you enroll, I start sending you Extra Money Job Sheets which start showing you how to do Radio repair jobs. Throughout your Course I send plans and directions which have helped many make \$200 to \$500 a year in spare time while learning. I send special Radio equipment to conduct experiments and build circuits. This 50-50 training method makes learning at home interesting, fascinating, practical.

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Act today. Mail coupon for my 64-page book, "Rich Rewards in Radio." It points out Radio's spare time and full time opportunities and those coming in Television; tells about my course in Radio and Television; shows many letters from men I trained, telling what they are doing and earnings. Read my money back agreement. Find out what Radio offers you. Mail coupon in envelope or paste on penny postcard—NOW.

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Dept. OBP, National Radio Institute
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Dear Mr. Smith: Send me FREE, without obligation, your 64-page book "Rich Rewards in Radio" which points out spare time and full time opportunities in Radio, those coming in Television, and explains your 50-50 method of training men at home in spare time to be Radio Technicians. (Write Plainly.)

NAME.....AGE.....

ADDRESS.....

CITY.....STATE.....

This One



The Mechanism of Mind



WHY YOU ARE AS YOU ARE—

and *What You Can Do About It!*

DID you ever stop to think *why* you do the things you do? Have you often—when alone—censored yourself for impulsive urges, for things said or done that did not truly represent *your real thoughts*, and which placed you at a disadvantage? Most persons are *creatures of sensation*—they react to instinctive, impelling influences which surge up within them and which they do not understand—*or know how to control*. Just as simple living things involuntarily withdraw from irritations, so likewise thousands of men and women are content to be motivated by their undirected thoughts which haphazardly rise up in their consciousness. *Today you must sell yourself* to others—bring forth your best abilities, manifest your personality, if you wish to hold a position,

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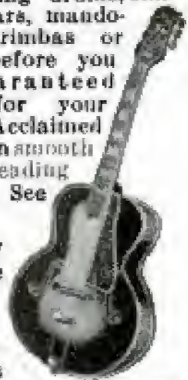
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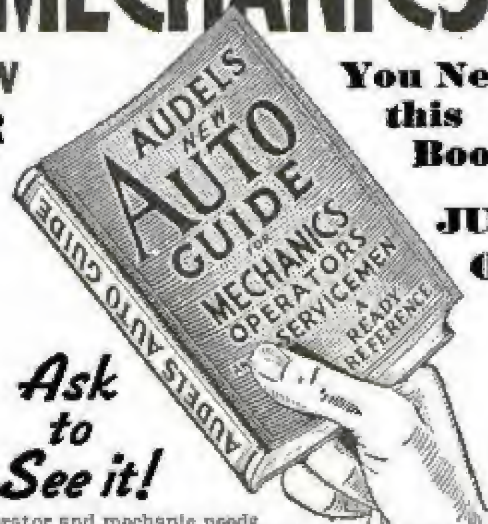
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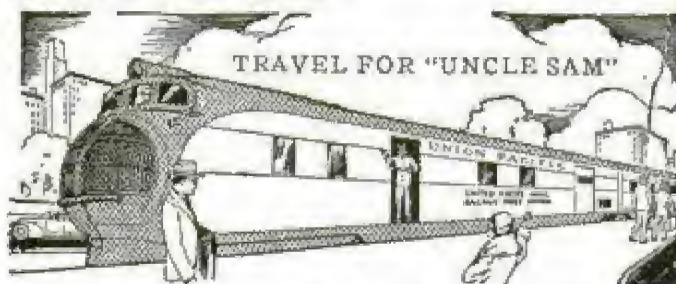
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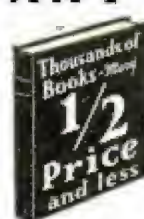
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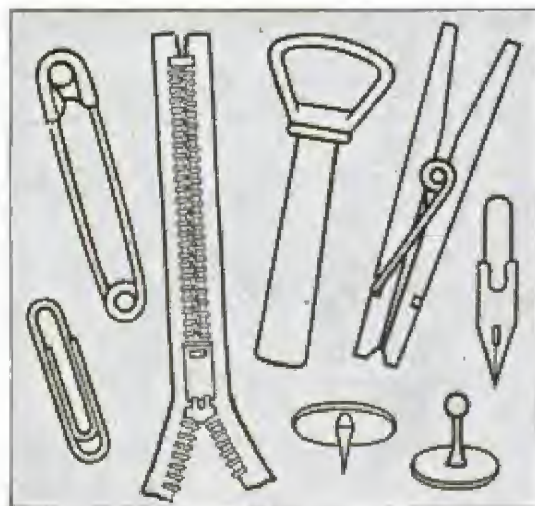
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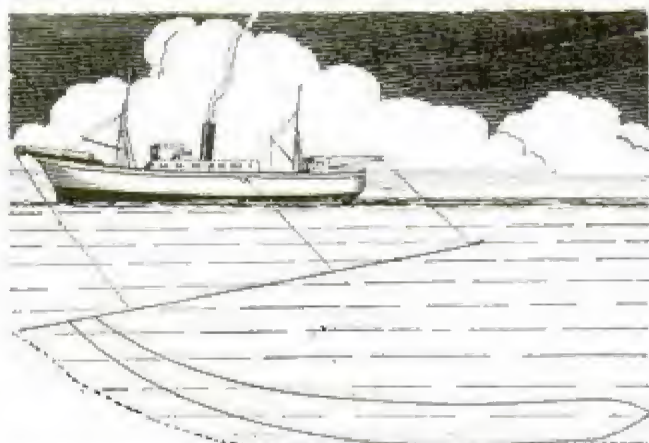
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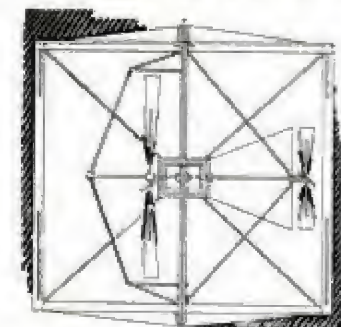
INVENTIONS

SURVEY of the ocean floor would be made easier by recently patented apparatus for determining the slope of the bed of a body of water. The device is intended to be drawn along the ocean floor by a ship on the surface. It has means op-



erable under water for transmitting signals corresponding to angular positions assumed by the device as it travels along the sea bed. A receiver on the ship would pick up these signals and translate them into degrees, thus giving the surveyors a means of mapping the submarine area.

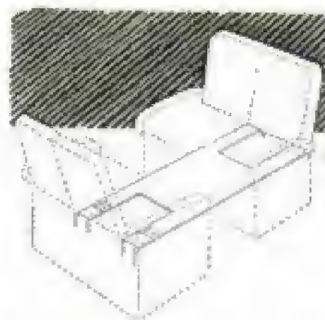
HARNESSING the wind has been man's goal for a long time. Now comes an inventor with an idea for a wind-propelled turbine motor, on which a patent has just been issued. It consists of several motor units connected together and each equipped



with a drive shaft and a power takeoff connected to each shaft. Each of the motor units would have a frame in which there is a tube extending around the drive shaft and formed with a gear box. Wind wheels

are mounted on the propeller shafts, with the blades of the respective wind wheels oppositely inclined. Gearing within the gear box would turn the drive shaft as the wind wheels rotated in opposite directions. The power plant is a sort of super-windmill.

SIMPLE conversion of two facing seats in a railway coach into a bedlike arrangement is the purpose of a recently patented device. It consists of a rectangular flexible bridge, attached to each of the seats and arranged to support the user's body in the space between the seats. Attachment to the seat is effected by means of straps and hooks. The device is intended to give the day-coach passenger an added measure of comfort in sleeping.



SOMETHING new in motor propulsion of the bicycle is found in a newly patented arrangement. It consists of a motor supported between the front and rear wheels and a transmission that has a small wheel for engaging the rear tire at the approximate height of the bicycle chain. This small wheel turns the bicycle wheel, thus driving the cycle. A lever located in convenient position for the rider permits disengagement of the small wheel from the tire. Pedals and the usual drive are retained.



(Continued to page 35A)



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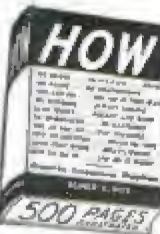
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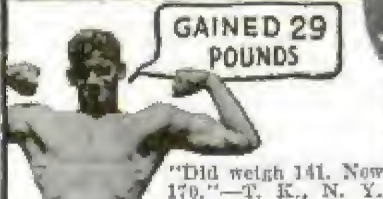
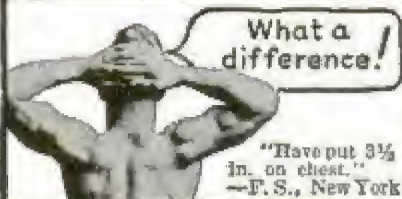
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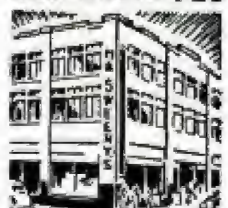
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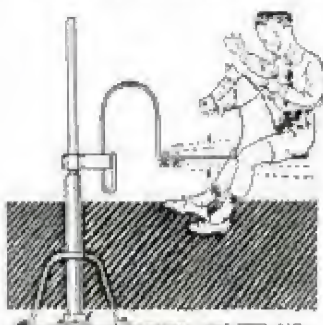
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POPULAR INVENTIONS

(Continued from page 22A)

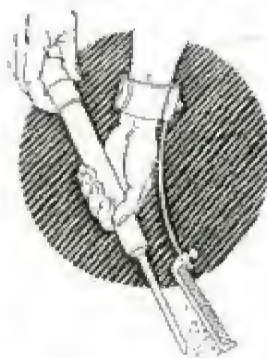
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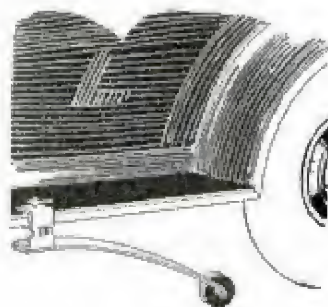
It includes a heavy vertical shaft to which is attached an arched spring, ground or floor supports for the shaft and a plank on which the rider sits. The arched spring connects the shaft and the riding plank. The device permits the child rider to bounce, in bucking bronco fashion, or to seesaw. The pony-riding effect is further enhanced by attachment of a wood or metal piece, shaped like a horse's head, to the plank just in front of the seat.

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(Continued to page 58A)

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SEWING Machines electrified. Complete outfit \$7.85. Particulars. Domestic Electric, 118 East 28th, New York.

ELECTRICAL Work and hundreds of other new, money making and money saving ideas. 1940 Shop Notes, 50c. Popular Mechanics Press, Room C40, 200 E. Ontario, Chicago.

AIR CONDITIONING

FURNACE Blowers \$22.50, 13" wheel. Also larger sizes for cooling, air conditioning. 2,500 CFM to 30,000 CFM, \$47.50 to \$265.00. Variable speed control, belts and pulleys included. Reynolds Mfg. Co., Grand Rapids, Mich.

ELECTRIC FENCING

ELECTRIC Fencer easily made from old automobile coil. Complete plans 10c. LeJay Manufacturing, 947 LeJay Building, Minneapolis, Minn.

BIG Money building-selling electric fences. Tremendous demand. Lowest wholesale prices. Free information. Hughes, 6 Miami, Terracorpark, Ohio.

WELDING—SOLDERING—PLATING

OXY-ACETYLENE Welding outfits, \$19.95; combination welding and cutting outfits, \$35.64; heavy-duty welding torch, with tips, \$11.25; light welding and sheet metal torch, \$7.50; acetylene generators, \$50.00. Superior Oxy-Acetylene Co., Hamilton, Ohio.

D.C. Arc-welder plans \$1.00 each (three for \$2.00). Build it yourself without rewinding armature. 25-200 amperes from farm light plant generators. 25-200 amperes from Northeast, Dodge automobile generators. 25-600 amperes from d.c. vehicle motors originally storage battery driven. Welders Club, AB-3432 M-Mart, Chicago. For sale: D.C. vehicle motors, supplies, etc.

GUARANTEED Solder for aluminum, trial sample 25c coin. Pierman, Box 101, Belmar, N. J.

A.C. Welders. Plans, material. Save money. Holgeron's Service, Canton, Kans.

WE Nickel plate pistols, etc. Write, Globe Company, Fitzgerald, Ga.

ACETYLENE Welding generators, latest type. \$25.00. Johnson Generator Co., Brookfield, Missouri.

WELDING Equipment, demonstrator bargains. Request list. Hobart Welders, Box M-2404, Troy, Ohio.

ELECTROPLATE Small parts. Low-priced outfit for laboratory or amateur. Choate Manufacturing Co., 3464-E Principle Ave., Cincinnati, Ohio.

100 AMPERE Transformer ready for instant welding, five heats, operates 110 volts 60 cycles, asbestos insulated, scientifically air-cooled. A rugged unit for practical use, \$16.50, larger sizes available. Transformer Supply Co., Sherry Building, Long Island City, N. Y.

REBUILT a.c. d.c. Arc welders, all sizes; engine governors, idlers. Terms. Low prices. Guaranteed. Service Co., 3732 Cedar Ave., Cleveland, Ohio.

SEE Our display advertisement on page 142A. LeJay Manufacturing Company.

ENGINES, MOTORS, DYNAMOS

MAYTAG Gasoline multimotors—Completely rebuilt, refinished, guaranteed. For washers, lawn-mowers, pumps, sheep-shears, paint sprays, cultivators, power tools, small automobiles, etc. Rated 1/4 horsepower. Specifications on request. \$17.50 i.o.b. Wilson Electric Co., Washington, Penna.

MAKE Money, rewind auto generators, washing machine motors, construct arc welder, 10c brings particulars. Catalog material. Ernest Knight, LaSalle, Illinois.

SMALL Elect. motors, with flexible shafts \$3.25 postpaid. McConnell, 1619 Edgewood, Racine, Wis.

600 NEW Motor diagrams, tables and controller connections for the practical electrician. Makes dual voltage, multi-speed, star and delta circuits clear and simple. Also includes all standard split phase, repulsion induction, compensated series, two and three phase. Data for re-winding and reconnecting all types. Over 100 valuable tables. Money-back guarantee. Price \$2.00 prepaid. Educational Advancement Company, Lakewood, N. Y.

GOVERNORS, Auto engine, \$5.00 up. Candee, Llewellyn St., Los Angeles.

PRICELIST Free. Motors; drills; grinders. Home workshop tools. Mailorder Electric, 721 South Dearborn, Chicago.

CLEAN Used oil without cost. Particulars. P. Gerwin, Fairview, Okla.

BARGAINS—Plating generators, motor generator sets, also arc welders. New low prices for large and small shops. Trial—easy terms if desired. Hobart Bros., Box M-2406, Troy, Ohio.

MOTORS, 1/4 H.P. General Electric, etc. \$3.50, guaranteed. Larger sizes, list 10c. A. C. Motors, 3008 Bailey, Philadelphia, Penna.

RELIABLE Motor winding books. Lessons, connecting diagrams, winding data. Introductory data selection, \$1.00. Motor Data Co., Box 7631, Kansas City, Missouri.

AIR Compressors 1 1/4"x1 1/4", \$6.00; 2"x2", \$7.00; 2 1/2"x2", \$8.00. Free catalog. National, 1915 South State Street, Chicago, Ill.

ALTERNATING, 1/2 Horse, 110 volt, induction motors, Rebuilt, guaranteed, \$7.25. Wilmut Auto Supply, 2247 St. Paul Ave., Chicago.

THREE To ten KVA alternating generators. Motors, converters. State your needs. Queen City Electric, 519 South California, Chicago.

BARGAIN—1 1/2 Hp. motor, 60 cycle, 1 phase, 110 volt, like new, guaranteed, \$7.40. Send check to Erie Electric Motor Co., 120 Church, Buffalo, N. Y.

REWINDING Motors and 336 other valuable articles in Shop Notes, Vol. 31—50 cents postpaid. Popular Mechanics Press, Room (C40), 200 E. Ontario St., Chicago.

MACHINERY, TOOLS AND SUPPLIES

BUILD Your own machine tools. Castings and blue prints at nominal cost. Send 10c for 2 color 28 page catalog, 34 prints covering 12 metal-working projects, \$1.50. 23 prints covering 6 wood-working projects, \$1.00. Lewis Machine Tool Co., Dept. M-2, 1000 Alhambra Ave., Los Angeles.

HIGH Quality power tools at lowest prices. Sturdy and efficient bench tools and model makers. Write for free catalog. Arcade Mfg. Co., 1219 Shawnee St., Freeport, Illinois.

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DRILLS, Reamers, cutters, taps. High speed, 80% savings. Kish, 1040 Vinewood, Detroit, Mich.

BEARING Bronze, make it without special equipment. Write Box 304, Webster City, Iowa.

NEW 1/4 Hp. elect. motors \$8.60. Drills, grinders, Catalogue 10c. United Industries, 321 Broadway, Denver.

TREMENDOUS Surplus of factory tools selling out. Drills, taps, files, hacksaws, etc. Send for free lists, include six cents postage. Travers Tool Co., 264 Jackson Ave., Long Island City, N. Y.

14" x 6' GREAVES Klusman cone head engine lathe, quick change. No. 6 Cincinnati miller, cheap. Write for particulars. Cincinnati Machinery & Supply Co., 221 E. Second St., Cincinnati, Ohio.

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GENUINE New Evinrude and Elto outboard motors now as low as \$26.50 (plus small transportation charge.) Down payment as low as \$6.00. Fifteen advanced 1940 models to choose from. Write for catalog, boat directory and handy Boat-and-Motor Selector—all free! Address: Evinrude Motors, 4284 N. 27th St., Milwaukee, Wis.

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TEN Plywood boat plans 50c. Free catalog boatbuilding plans. The Rudder, 15 Murray St., New York.

OVER 300 Rebuilt outboard motors. Fully guaranteed. All makes. 5c brings complete data. Masters & Son, 808 N. Clark, Chicago.

COMPLETE Kayak construction kit \$10.00. Big value. Playaks, Dedham, Mass.

KAYAK Blueprints, deluxe models—catalogue 10c. Viking Kanoes, Merrick, N. Y.

OWN A fine boat at a great saving. Build a Welch boat. We supply all materials cut to shape for skiffs; rowboats; runabouts; and cruisers. Send 10c for a 32 page catalog showing boats, marine supplies, etc. Welch Boat Company, Station K-1, Milwaukee, Wisconsin.

BOATS \$18.50 up, with oars. Write P. E. Lescault, Vercheres, Canada.

FORD-Mercury-Zephyr marine conversions. Catalog 10c. Lehman Engineering Company, Dept. D, Newark, N. J.

OUTBOARD Motors, all makes. Used motors and parts. Stamp brings motor list. Outboard Headquarters, 305 Atlantic Ave., Boston, Mass.

BOAT Plans, building instructions by famous architects. 300 designs, all types—outboard, inboard, sail—cruisers, runabouts, racers, utilities, etc. Compiled in book form containing up to 43 plans each at \$2.00 and \$3.00 per book. Free catalog. Motor Boating, 574 Madison Ave., New York.

MARINE Power—Easily convert any Ford motor (domestic and foreign) with Osco parts and kits. Complete catalogue 25c (coin). Osmitheon, 3644 Lawrence St., Philadelphia, Penna.

ASSEMBLE Your own boat. Our finished knock-down frames and materials save you 2/3 builder's cost. All types and sizes. Send 25c for big catalog. Brooks Boat Co., Inc., D4, Saginaw, Mich.

OUTBOARDS—Save 1/2. Good used parts, all makes and models. Bargains rebuilt motors. Grandall Hicks Co., 959 Commonwealth, Boston, Mass.

BOAT Designers are highly paid professionals. Complete course by mail. Catalog. Westlawn, Montville, N. J.

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FISHERMEN! Tie your own flies—for pleasure or profit. My book tells all. Shows you how. Profusely illustrated. Practical. Mailed postpaid for \$1.50—(regularly \$2.00.) Free list of fly and leader materials and tools. Finest stock in America. Paul Young, 8065-C6, Grand River, Detroit, Mich.

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GUNSMITHING Readily learned at home. Earn extra money by repairing neighborhood's firearms. Free catalog 20 firearm and gunsmithing textbooks. Samworth, Marines, North Carolina.

"TRAINING Bags" for punch and speed, at cost price. Circulars 10c. Andre's Gym, 3520 Mt. Elliott, Detroit, Mich.

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ARCHERY Supplies, catalogue free. Instruction book 50c. Midwest Archery, 2209-A East 75th, Chicago.

HUDSON Bay blankets, complete camping, hunting, outdoor equipment. Catalog. Howe Fur Company, Coopers Mills, Maine.

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"MODERN Taxidermist Magazine," Greenfield Center, N. Y. Devoted entirely to taxidermy. Three sample copies 25c.

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GUARANTEED Live arrival, guaranteed songsters. Seeds, supplies. Write for price list. Universal Bird Co., P.O. Box 7, Bergen Station, Jersey City, N. J.

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SELL Famous chicks. Make quick money. Make to \$3.00 per 100. Cash profits paid in advance. More Famous Hybrid chicks sold than any other kind. World leaders. Thousands chicks hatched daily. Also leading pure breeds. World's Poultry Congress winners. No selling experience needed. Full details free. Write, Famco, Shenandoah, Iowa.

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CHICKS—Sexed or unsexed. 52 pure-breeds, 6 hybrids. Business 45 years. Free poultry book. Berry's Farm, Route 13, Clarinda, Iowa.

40,000 CUSTOMERS in 40 different states annually buy 10,000,000 Davis chicks for broilers and layers. 21 different breeds. Sexed chicks, poult, ducks, \$3.45—100 and up. Free catalog. We guarantee chicks for 14 days. Immediate delivery. Davis Poultry Farm, Route 34, Ramsey, Indiana.

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BEAUTIFUL Small farm, 7 cows, crops, tools, etc., included; 40 acres, very fertile, near fine town; dandy 7-room house, good 65 ft. cement-basement barn and silo, hen houses, etc.; only \$1900, good terms; page 47 free 100-page catalog. Strout Realty, 255-P 4th Ave., New York City.

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CANADIAN Tax sale lands for a dollar an acre and up. Small monthly payments. Farms, timber, hunting and fishing camps, minerals. Limited number of properties. Write at once for free illustrated booklet. Tax Sale Service, Room 613, 72 Queen St. W., Toronto, Canada.

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SACRIFICING Dealers' approvals. \$1.50 value \$1.00; \$4.00 value \$2.00; \$11.00 value \$5.00. Smith, 669 Chili, Rochester, N. Y.

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THE World in a packet. An outstanding value! 100 stamps from 100 different countries, including Abyssinia, Afghanistan, Brunei, Falkland, Samoa and others from Africa, Asia, South America, West Indies, etc. Our pamphlet which tells "How to Make a Stamp Collection Properly," together with our large bargain list of albums, packets, sets, etc. All for only 20c. Queen City Stamp Co., 604 Race St., Room 36, Cincinnati, Ohio.

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SEND For free giant money saving radio and phonograph record catalogue. United Radio Company, 1000-M, Newark, N. J.

RADIO Kits—\$3.95 up. Complete. Single band; all-wave; 5-10 tubes. Radio and parts catalog free. McGee Radio, FP-10, Kansas City, Mo.

MUSIC AND MUSICAL INSTRUMENTS

LEARN Swing piano! Postal brings free folder. Christensen, 751 Kimball Hall, Chicago.

SONGWRITERS! Poems, music. Amazing offer. Hibbeler, C-5, 2157 N. Avers, Chicago.

SONGWRITERS. Write for free inspiring booklet outlining new opportunities for amateur songwriters. Allied Music, Dept. 4, Box 507, Cincinnati, Ohio.

POEMS, Melodies. Publication. Place-ments. Best opportunity. Songland, "D40PM-1," Thomaston, Maine.

SONGWRITERS—Agents. new sales plan. National Music-D, 532 Sixteenth, Oakland, Calif.

PIANO By ear. Free booklet. McKee School, 6842 Sunset, Hollywood.

SONGWRITERS—Send poems: free plans, reports. Variety, Dept. H, Salem, Indiana.

SONG Writing pays—Let successful song writers set your poems to music. Five Star Music Master, 6 Beacon St., Boston.

POEMS Wanted. Work guaranteed. Publishing. Great Eastern, "D27," Thomaston, Maine.

START Own orchestra, make money, you be drummer, play immediately, new copyrighted system, \$1.00. Class' Drum School, 3609 Stoer, Cleveland, Ohio.

SONGS, Lyrics, composed, published, royalty basis, wonderful opportunity. Free information. Melody World Music Publishers, Garfield, Building, San Francisco.

ONE Dollar brings you twelve guaranteed clarinet reeds. Soft, medium, stiff. State choice. Money back if not satisfactory. Box 413, Mansfield, Penna.

FIFTY Late phonograph records, \$2.50. Wurlitzer selective, amplified, 12 record phonographs, very cheap. Davis Sales Co., Syracuse, N. Y.

PIANO By ear. Free booklet. Day-V-Way, 13265 Michigan Ave., Dearborn, Michigan.

ONLY Published songs bring dividends and popularity. For important information write Sunbeam Publications, 20 West Jackson, Chicago.

RECORDING Songs, poems, dollar per minute. Ray Turner, Hotel Tilden Hall, Champaign, Ill.

SONGWRITERS—Write today for free booklet "Building An Income Through Songwriting." Songwriters Institute, 1234-C Broadway, New York.

WANTED: Original poems, lyrics, songs by a recognized music organization. Our contracts guarantee publication, marketing; include expert collaboration, where required. We give you advantages not obtainable elsewhere. Send your material today. Music Publishers Agency, Dept. X12, Portland, Ore.

MUSIC Composed to words. Rhyming pamphlet on request. Phonograph recording of completed songs. Send poem for consideration. Keenan's Studios, Dept. PM, Box 2140, Bridgeport, Conn.

DUO-FLEX Reeds for clarinets, and saxophones eliminate your reed troubles. Write for circular. Duo-Flex Reeds, 1204 1st Ave., Evansville, Ind.

MUSIC Composed to words. Wonderful proposition. Bauer Bros., Oshkosh, Wis.

WRITE Songs. Big money and reputation. Write for information. J. Gordon Pub. Co., 201 N. Hoyne, Ave., Chicago.

WANTED! Lyrics, melodies for songs. We arrange, publish, sell. Superior Song Studios, Passaic, N. J.

SONGWRITERS: Send your poem today for immediate consideration. Richard Brothers, 24 Woods Building, Chicago.

SONG Writers. Send for publishing agreement. McKinley Music Publishers, 1501 E. 55th St., Chicago.

SONG Poems wanted. Free examination. Send poems to McNeil, Master of Music, 510-PM So. Alexandria, Los Angeles, Calif.

SONGS, Song poems, bought, published. Best offer, free advice. Metro-Melody Music Publishers, 1204 Sutter, San Francisco.

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BUILD A business of your own. Grind lawn mowers the Universal way. Small investment—large profits. Every customer satisfied. Write for Booklet "T. Rogers Manufacturing Company, Lindsey, Ohio.

START Your own business. Pleasant work at home. Big profits. Atlas Service, Red Lodge, Mont.

MANY Money making ideas, handy household article free. Profit Guide Service, 1585 Broadway, 303V, New York.

MAKE Sell finest maple syrup, homes, restaurants. Cost 7c a pint. Big profit. Send \$1 for formula, full instructions. We include maple flavor enough for 4 gallons postpaid. Manufacturers Sales Co., 301 West 29th, New York.

FREE Amazing Folder about Artificial Marble Flooring. Covers Wood or Cement Floors. Fireproof. All colors. Low Cost "Ornamental Casting"—Concrete—Plaster—Statuary—Garden Furniture—Flexible Molds—Liquid Marble. Creative Publishers, PM-2, Glenview, Illinois.

110 MONEY-MAKERS. At home. City or country. Write: Home Service Bureau, Box 4079, South Edmonton, Canada.

OPPORTUNITY Of doing business by mail. Particulars for stamp. Eastern Sales Service, Box 101, Millville, N. J.

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A BUSINESS Of your own. No fruitless experimenting. We'll plan your entire business campaign and guide you step by step to success. Write for details. Reliable Service, Box 923, Denver, Colorado.

YOU'LL Like resilvering mirrors, auto-parts, reflectors, making chipped glass signs. Write Sprinkle, Plater, 127, Marion, Indiana.

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NEW Money makers. 70-page mailorder magazine, prints hundreds new, novel, sparetime plans monthly. Sample copy 10c. M. Marvin, Publisher, 330 South Wells, Chicago.

OPERATE Movie shows in theatreless communities. Earn \$50.00 to \$100.00 weekly right away. No experience. We furnish projection equipment, talking film programs. Show us everything. Southern Visual, Dept. PM-4, 494 S. Second, Memphis, Tennessee.

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OPPORTUNITIES. Profitable, permanent, no freaks. Sample, dime. Gammell, Dedham, Mass.

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CASH. Newspaper clippings. Write Galvin, B724, 207 E. 84, New York City.

PLASTEX Industries offers industrious men an opportunity to start a business of their own, manufacturing art goods, novelties, souvenirs, etc., in Plastex and marble imitation. 5c material makes \$1 articles. Rubber moulds furnished for speed production. Small investment brings big returns. You are just in time for big wholesale season now starting. Write for interesting booklet mailed free. Plastex Industries, Dept. A, 1085 Washington Ave., New York.

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QUICK Income! Fast-growing business creates lasting independence; attention, intelligent effort, required. Service, Drawer 339-5, Butte, Montana.

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MAIL Order business course will show you how to make money, spare or full time. Teaches professional mail order technique; not penny-catching schemes. Write for free details today. Nelson Co., B-404 Manhattan Building, Chicago.

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MONEY In "names"! Free instructions. Mail Service, 2231 McKinley, Berkeley, Calif.

"BINGO." New coin operated amusement game. Large income, operating "route." \$150 investment. Details free. Robbins, 1141P DeKalb Ave., Brooklyn, N. Y.

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MAKE Artificial marble, glazed tiles, uncanny. Tabletops, plaques, floors, homes, novelties. Hard, fireproof, inexpensive, cement secrets. Brilliant tile and liquid rubber samples 3c. John A. Payn, 945 Grande Vista Avenue, Los Angeles, Calif.

20 MONEYMAKING Plans; not just ideas—complete operating details. Send 25c. Business Guide, 502 Dryades, New Orleans.

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INVENTION Finance Magazine. 80-G Wall Street, New York. Important particulars free.

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CHIPPING Glass signs. Folder free. Beveridge, 180-22 P Locust, Jamaica, N. Y.

A REAL Future for you with Red Comet Automatic Fire Extinguishers. Low price. Proven seven years. Splendid sales outfit free. Some good territory open. Exclusive. Write quick. 706 Red Comet Building, Littleton, Colorado.

INVENTORS—We successfully sell inventions, patented and unpatented. Write for proof, and tell us what you have for sale. Chartered Institute of American Inventors, Dept. 4-C, Washington, D. C.

GOOD Paying business silvering mirrors, plating autoparts, reflectors, bicycles, bathroom fixtures by late method. Free particulars and proofs. Gunmetal Co., Ave. H, Decatur, Ill.

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MAIL Order business is your opportunity. Many began small, now earn thousands yearly. No personal contact. Boundless opportunities. Have had over 30 years experience; will help you succeed. Send 25c for valuable booklets, none free. B. Brenner, 257 S. 21st, Philadelphia.

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24 WAYS To make money 50c coin. Orville Earhart, Hollenberg, Kansas.

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PROFITABLE Home business selling formulas by mail. Geer, Box 515, Fabens, Texas.

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POSTCARD Addressed Excello Sales, Shreveport, Louisiana, brings best proposition ever received.

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AMAZING Profits. Day-night, year round. No selling. Operate "Silver King" vendors. \$3.25 up. Free instructions. Automatic, 2425A Fullerton, Chicago.

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CASH Paid for insects. See Sinclair display advertisement on page 16A.

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YOU'LL Like resilvering mirrors, auto-parts, reflectors, making chipped glass signs. Write Sprinkle, Plater, 287, Marion, Indiana.

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RAISE Earthworms for profit. Information free, stamp appreciated. Bureau Zoological Research, 106A Broadway, Peoria, Ill.

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"1000 PROVEN Ways of earning money"; rent this book 30 days for only 10c. Particulars free. Smith Book Service, W. Palm Beach, Florida.

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300 BUSINESS Plans, formulas, bargains, secrets, that will earn money for everyone! Send 50c to Singer Research Service, Box 1970, Cleveland, Ohio.

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BEAUTIFUL. Gem-like plastics, castable and thermosetting. Experiment. Five formulas, different types—one dollar. Supt. Rose, Benton, Mississippi.

STEPHEN'S Formulas are practical. Make and sell your own products. Can furnish most any formula (or money refunded.) 50c each, 3 for \$1.00. No stamps. Satisfaction guaranteed. Stephens, 116 Pratt, Minneapolis, Minn.

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ELITE Formulas and plans; make and sell your own products. Descriptive booklet free. Elite Co., 214 Grand St., New York.

NEW. Money making formulas book tells how to go into business for yourself. Send for free details. Popular Mechanics, 200 E. Ontario, Chicago.

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FREE Catalogue. Chemistry, mineralogy, biology, microscopes, telescopes. Tracey Laboratories, Evanston, Illinois.

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CHEMISTRY Course at bargain. Particulars. A. Shadereau, 620 E. 8th St., Brooklyn, N. Y.

CHEMICALS. Laboratory, glassware, apparatus. Send 3c for catalog CP1. Biological Supply Company, 1176 Mt. Hope Avenue, Rochester, N. Y.

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SALARIED Positions—\$2500 yearly and up. Let us find one for you. Write for valuable information. Executive's Promotion Service, (16), Washington, D. C.

\$30 WEEKLY. Grow mushrooms. Cellar, shed. We buy 35c lb. Mr. B. made \$270 spare time. World's largest company of its kind. 40 page book free. Mushrooms, Dept. 701, 2019 Second, Seattle, Wash.

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EARN Money in your spare time taking subscriptions to Popular Mechanics. Unlimited possibilities, every family a prospect. Easy to sell. Bonus paid in addition to liberal commission. Send postcard for further details today. Circulation Dept., Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

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WRITE For free samples amazing stain-proof tablecloths. Clean with damp cloth. Require no ironing. Beautiful patterns. Look like linen—cost much less. Commissions big. Also complete line of dresses. Melville Co., Dept. 1542, Cincinnati, O.

CALL On friends with greeting card assortments. Easter, birthdays, other occasions. Big demand. Big profits. Also personal stationery. Experience unnecessary. Samples free. Wallace Brown, 225 Fifth Ave., Dept. K-34, New York.

GIFTS For housewives. Cash income for you. Make real profits on easy-to-get daily orders for groceries, 200 other necessities. Amazing variety of premium gifts—hand out with every order. Full spare time. Big display products, premiums, samples furnished qualified dealers. Togstad Co., Dept. M-16, Kokomo, Ind.

WANTED: Reliable man or woman to test food products at home, and later take orders if samples are satisfactory. \$6.00 worth full size products free. Send no money. Write Blair, Dept. 31-T, Lynchburg, Va.

WRITE Quick for amazing new line of men's shirts and sport ensembles. Easiest sellers. Low as 3 for \$2.98. Beautiful Sanforized fabrics, exclusive features. Money back guarantee. Big profits assured, repeat business. Valuable outfit free. Stylewear, Dept. A-114, Erie, Penna.

STRANGE Chemical sponge cleans wallpaper like magic. Banishes housecleaning drudgery. Sensational demonstration. Samples sent on trial. Rush name. Kristee, 115, Akron, Ohio.

MEXICAN Curios sell on sight. Large profits. Free particulars. Samples 10c stamps. Marquez-PS, Apartado 1176, Mexico City.

MAKE And sell your own products. No machinery needed. Amazing profits. Guaranteed "Chemist Approved" formulas. Catalog free. Kemico, 10-B, Park Ridge, Ill.

MONOGRAMMING Automobiles real money maker. Write for samples. International Co., Box 9360, Philadelphia, Pa.

YOUR Hose free with outfit. Make up to \$32.50 in a week taking orders for amazing new hosiery. Replacement guaranteed against holes, snags, runs. Rush name, hose size. Wilknit, Desk BB-37, Greenfield, Ohio.

MAGIC Disc heats water without gas, coal or oil. Tremendous seller. Big profits. Pocket samples for agents. Rush name for free offer. Nuway, Dept. X-162, Des Moines, Iowa.

500% PROFIT! Transfer sign letters for windows, offices, trucks, signs. Colors: gold, silver, red, many combinations. Auto monograms. Easily applied. Neonite, Akron, Ohio.

LOCAL Agents wanted to earn bonus suits and demonstrate to friends. Up to \$12 in a day easy. Experience unnecessary. Valuable demonstrating equipment, actual samples absolutely free. H. J. Graves, 1300 Harrison, Dept. C-817, Chicago.

BUSINESS Proposition restilvering mirrors, autoproducts, reflectors, making chipped glass signs. Write Sprinkle, Plater, 128, Marion, Indiana.

SUCCEED With your products. Make-sell them. Formulas, Processes. Accurate analyses. Catalog free. B. Thaxly Co., Washington, D. C.

FREE To reliable man—\$6 worth household products to start profitable home operated business. Can be handled spare time. Earnings start at once. Opportunity to make good living. Get details. Zanol, 3513 Monmouth, Cincinnati, Ohio.

MAN Wanted to supply Rawleigh's household products to consumers. We train and help you. Good profits for hustlers. No experience necessary. Pleasant, profitable, dignified work. Write today. Rawleigh's, Dept. B-53-PPM, Freeport, Ill.

UP To 500% profit with new perfected 1940 quick action, no flint, automatic gas lighter. Retail 25c. Sample 10c. New Method Company, Box PMG-86, Bradford, Penna.

AMAZING Oil burner, slips in old stove, range, furnace: quick heat at valve turn; no drudgery, ashes; easy seller. Sent on trial. Atlas, Box 6058-VX, Kansas City, Mo.

PROFIT Leaders. Fast selling specialties. Electric shavers 79c. Imprinted pens, etc. National Supply, Fosston, Minnesota.

AGENTS Wanted: Every man a prospect for "Edgecomb," the perfect hair trimming device. Enables anyone to trim own hair. Keeps it in perfect form always—never too long, never too short. Look smart. Sample for self and taking orders \$1.00 postpaid. Liberal commissions. Warner Products, (Dept. PM), Norwich, Conn.

AGENTS—Easy money selling Oilco magic range oil burner cleaner. Amazing results, repeater. Send \$1.00 for samples, full particulars. Organic Research Laboratories, 330 Atlantic Ave., Boston, Mass.

UP To 500% profit selling fast repeating daily necessities, housewives everywhere must buy. Lloyd's, 3 No. Paulina, Chicago.

SALES Books bring you biggest profits. \$4.75 per 100, commission \$1.50. Other printed necessities. Free catalog. General Printed Products Corporation, 49 West St., New York.

THE New scientific discovery. Speedee the perfect waxing aid. Wax plus Speedee gives quick high lustre. Sells easily on demonstration to garages, gas stations, etc. Send 25 cents in coin (no stamps) for trial package and sales proposition. Veedee Products, Station "B," Box 34, Buffalo, New York.

START Your own business stamping social security plates. Easy work. Big profits. Send for pamphlet illustrating inexpensive outfit. Morton Sales Company, P.O. Box 93, Flatbush Station, Brooklyn, N. Y.

MONUMENTAL Agents wanted. All leading granites. Guaranteed. Prepaid. Liberal earnings. Protected territories. Mikelich Company (Manufacturing), St. Cloud, Minn.

FAST Selling novelty fun package. Seven novelties 5c, retail \$2.50 100 packages. West Shore Novelty Co., 370 Beach St., West Haven, Conn. (PM.)

EARN \$6 A day and up. Spare or full time. No selling. Write Henry, 5472 Lake Park Avenue, Chicago.

SELL Combination baseball game and schedule. Easy sales. Big money. Caso, 75M West 45th Street, New York.

500% PROFIT. Gold and silver colored sign letters. Offices—stores. Large sizes 1c. Free samples. Modernistic, T-3000 Lincoln Ave., Chicago.

PROFIT With new products. Make, sell, repeat. Analysis. Research. Guaranteed formulas. Biggest catalog free. Nominal prices. Gibson Laboratory, Chemists, BD-1142 Sunnyside, Chicago.

MANUFACTURE Specialties, hire agents yourself. Big money. Free literature. Gilbert Supply, 5-PW 24th, New York.

AMAZING Zipper clothesline. Instant demonstration. Sells on sight. Dunn Mfg., Hempstead, N. Y.

NEW Products: Inventions. Golden opportunity. Paramount Produx, 18834 Marx, Detroit.

STRANGE Ironing cord! Abolishes kinks, snarls. Prevents scorching. Saves time. Saves work. Saves electricity. 100% profit. Exclusive territory. Big offer free. Neverknot, Dept. 2-A, 4525 Ravenswood, Chicago.

MAKE Time count. If your sales-time is limited, sell our Vision Improver. At least half of those you talk to, buy one or more. Sell singly or groups, offices, clubs, etc. 20c price, dime profit. Fifty weigh less than two pounds. Sample and terms free. Nu Du, 11½ Lake St., Nashua, N. H.

SELL Famous Glas-Glo. Big profits. Great repeater. Busy season beginning. Write for very special get acquainted offer. Glas-Glo Co., Box 144, Phelps, N. Y.

FREE Sample. E-2-Way metal polisher. No liquid, paste or powder. Quick demonstrations, big profits. Superior Specialties, Dept. 18, Springfield, Illinois.

SUPER Profits! 50,000,000 prospects. Brand new auto power product. Harmless—guaranteed. Information free. Thermo Power, Peoria, Ill.

AGENTS: Smash go prices! Santos coffee 12c lb. 4-oz. vanilla 8½c. Razor blades 10 for 8½c. 100 sticks chewing gum 12c. 150 other bargains. Premiums. Experience unnecessary. Carnation Company, P.O. St. Louis, Mo.

CAR-OWNERS To put up our signs. Fine offer for anyone traveling. (Not for kids.) Get details. Atlas Sign Works, 7941 Halsted, Chicago.

GOOD Paying business silvering mirrors, plating autoparts, reflectors, bicycles, bathroom fixtures by late method. Free particulars and proofs. Gunmetal Co., Ave. N. Decatur, Ill.

NOVEL Kitchen article. Multiple repeat sales. No competition. 100% profit. Details, sample 25c. Cache Co., Box 729, San Diego, Calif.

NEW—Different—Gas station "Service Signals." Knipp Specialty, Long Beach, Calif.

BRAND New item for agents, salesmen. Just out. Sells on sight. Every man needs 3 to 12. Rush name for money-making offer. Remark Mfg. Co., Dept. 8, Butler, Ind.

AGENTS—300% Profit selling gold leaf letters; stores and offices. Free samples. Metallic Letter Co., 438-B North Clark, Chicago.

AGENTS—Opportunity make money; book containing 127 successful business plans; home-office; send for free introductory booklet. Elite Co., 214 Grand St., New York.

NEW 10c Seller. Costs 1c. Western, 432 Clifton Bldg., Cleveland, Ohio.

SELL Fascinating Jitterbugs and carded merchandise. Dixie Supply, Rosslyn, Va.

AGENTS Make big profits on food products, bargain deals. Low wholesale prices. Rush name for trial outfit offer. Ho-Ro-Co, 2810-T Dodier, St. Louis, Mo.

AGENTS—To mail our literature. Good profits. Home business. Maywood, 1105-1107 Broadway, New York.

ENGRAVED Name plates, numbers, signs, etc., easily sold, profits large. Brett Bros., Winthrop, Mass.

DO You want agents for your proposition? Your ad in this space will place your message before hundreds of men seeking fast-selling products. My folder "How to Secure Agents," is filled with proof. I'll gladly send you a copy free. F. W. Johnson, Manager Classified Advertising, Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

BIG Money applying initials on automobiles. Easiest thing today. Free samples. Also, sideline salesmen for short order decalcomania name plates. "Ralco," 1305 Washington, Boston, Mass.

BIG Money applying initials on automobiles. Write for particulars and free samples. American Letter Company, Dept. 46, Dunellen, New Jersey.

REVOLUTIONARY Window cleaning tool. Good Housekeeping approval. Only ten \$2.25 sales daily to housewives, factories, schools, stores will make you \$350.00 monthly. Carter Products Corp., 900 Front Ave., Cleveland, Ohio.

FREE Sample—Amazing cleaner; sells homes, taverns, everywhere. Big profit—fast repeater. Betco, 5007 Irving Park, Chicago.

AGENTS: Stamping names on pocket-key protectors. Sample check with your name, address, 25c. Stamping outfits, Emblem checks, check-fobs, name plates, Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

HIGH-GRADE SALESMEN

PLACED On free trial to customers sells itself. Tremendous sales possibilities! Revolutionary inter-communication system. Talk to one or as many as ten people, even 2000 feet away. Loud speaking, back and forth, private conversation. Operates like radio—one electric connection. No servicing or installing problems. Fully guaranteed. Technical experience unnecessary. Easy two-minute demonstration. Thousands prospects—factories, offices, lumber yards, garages, parking lots, restaurants, etc. Accounts receivable carried by factory. Present low price opens big new field. Men earning high as \$100-\$150 week. Protected territory available. Free demonstrator offer. Inter-Communication System of America, 2440 Lincoln Ave., Dept. 303, Chicago.

SELL Printing at cut prices. 2,000 business cards \$1.50; 1,000 envelopes or statements, etc. \$1.75; 25 printed sales books \$1.50; 1,000 process embossed cards \$1.50; 2,000 two-color labels, free holder \$1.50; 2,500 printed handbills \$1.75. One-third comm. Free outfit. Bargain Ptg. Co., 189-F W. Madison, Chicago.

ADVERTISING Book matches—Sell union label book matches. Fastest selling line in America. Large sales producing kit, sample matches, complete cut catalog, eight color combinations make selling easy. Commission in advance. Superior Match Co., 7530 Greenwood, Dept. M-2, Chicago.

CLEAR Up to \$10 daily. Offer deluxe family Bible—\$1.95. Experts say worth \$5. Average \$1 profit. Size 8¼ by 11¼. Every home, church a prospect. Amazing value makes fast sales. Westcraft, Dept. 214, Racine, Wis.

NEW. Inexpensive, constantly repeating specialties for gas stations; garages; battery shops. Dill Products, East Weymouth, Mass.

PERMANENT Representative wanted for Hoover uniforms to call on restaurants, hotels, beauty parlors, doctors, nurses, others. Excellent income. Leads furnished. Equipment free. Hoover, Dept. AK-10C, 251 W. 19th, New York.

ADVERTISING Book matches offer liberal earnings—full, spare time. Experience unnecessary. Factory direct. Low prices for fine quality, quick deliveries, help get orders; faster repeats. All business firms prospects. Free outfit, instructions. American Match & Printing Co., Dept. 62, 4822 South Trumbull Ave., Chicago.

SELL Business cards \$1.50 thousand, business stationery, book matches, advertising gummed tape, pricing sets, paper towels, restaurant necessities, salesbooks, office supplies, advertising specialties, advertising pencils, 40% commission. Free deals. Sales portfolio free. Willens, 2130 Gladys, Dept. SF, Chicago.

IS Your job a "blind alley?" There's a real future in your own wholesale business. Profits can run into really big money. Start with little as \$2.50. Handle steady year 'round route of local stores. Collect, deliver orders for 200 nationally advertised 5c-10c counter products. Use home as headquarters. Chance to operate one of our Silver Fleet service trucks. No experience necessary. Facts free. World's Products Co., Dept. 10-P, Spencer, Ind.

SALESMEN. Distributors. 200 items, brushes, mops, marvelous magnetic brush—excels vacuum cleaner. Big profits. Neway Brush Co., Hartford, Conn.

WHOLESALE Genuine Marblette statuettes. Quick sales, large profits. Send stamp for particulars. Michigan Marblette Company, 1720 Milbourne Ave., Flint, Mich.

SELL Cra-Tex adhesive gauze bandage to physicians, industries, stores, house to house. Enormous profits. Desk S-12, Cra-Tex Corp., Omaha, Nebr.

TREMENDOUS Value, sells to all men. "Samples." R. H. Adams, Blanton, Penna.

ADVANCE Cash profits, bonus. Sell every factory, store, shop, office. Business increasers, advertising specialties. Free outfit. Write quick. Mutual, 753 East 64th, Chicago.

SELL Hot water bottle heaters that have been listed by underwriters. Fenwal Incorporated, Ashland, Mass.

SELL Low priced air-cushioned shoes to nurses, beauticians, waitresses, housewives. Unusual salesplan. Write: Daulec Shoes, 923 Washington, Dept. 67, St. Louis, Mo.

NEW Winter item with strong appeal to women. Can also be worn by all members of the family. Your cost 20c, sells at 39c per pair. Write for details. Clark Leather Products Co., 1811 W. North Ave., Chicago, Ill.

CALL On service stations, factories, restaurants, businesses, professions; with lettered advertising uniforms, shirts, work suits, etc. 100 styles. Exclusive features. Big advance commissions. Free outfit. Topps, Dept. C-7, Rochester, Ind.

LUNCHROOM Restaurant check salesman; also sell numbered printing. Nationally advertised house. Fast-moving sideline item. Liberal commission. Including repeat orders. Give references, experience. Arcus, 352 N. Ashland, Chicago.

START Your own steady repeat business. Make up to 200% profit. Handle "Original Underwood" typewriter carbon-paper and long life ribbons for well known office supply company established 65 years. Sold direct from famed Underwood factory at low prices. Wide open market for ambitious and aggressive direct salesmen. You offer customers exceptional value and endless satisfaction—make handsome profit margin on each sale. For full details write John Underwood & Co., Direct Sales Division "D-8," 30 Vesey St., New York.

BIG Commissions—selling to stores celluloid pricing tickets, metal shelf moulding. To restaurants, menu covers, signs. P. Pricing Press, 124 White St., New York.

SELL Firex—Automatic fire extinguisher and alarm. Endorsed by fire chiefs. Prospects everywhere—good commissions. Write for territory and testimonials. Firex Corporation, Dept. B-100, 516 South Broadway, St. Louis, Missouri.

SELL Complete line business necessities—over 1000 items. 50% savings to every merchant. Experience unnecessary. Samples free. Commissions advanced. Northwestern, 625-RR Jackson, Chicago.

SALESMEN To call on retail stores, new line chemical products. Liberal commissions. Weimald, 5852 Broadway, Chicago.

BLADES—Big profit line. Low factory prices. Leather stoppers. Postpaid. Ace Blades, Buffalo, N. Y.

ADVERTISING Book matches—Lowest prices. Big cash commissions. New outfit free. Gem Match, 74-F West Washington, Chicago.

A Real Future for you with Red Comet Automatic Fire Extinguishers. Low price. Proved seven years. Splendid sales outfit free. Some good territory open. Exclusive. Write quick. 704 Red Comet Building, Littleton, Colorado.

NEW Specialty—Sells every business and professional man. Four \$15 sales daily pay \$280 weekly. Farrell cleared over \$1,000.00 monthly. Write F. E. Armstrong, President, Dept. PM, Mobile, Ala.

EXCELLENT Opportunity selling our complete line of brushes, largest commissions. Write for sales plan. Wire Grip Sanitary Brush Company, 2300 5th Ave., New York.

EDUCATIONAL AND INSTRUCTION

AMAZE With extraordinary memory! Make learning easy! Remember names, dates, facts, ideas with incredible ease. "Super Memory" 7 lesson course tells how. Details free. Write, Info Company, Box 1122, Chicago.

SUCCESSFUL Stenographers, typists, bookkeepers, accountants, secretaries, social secretaries trained in home study department. Write for folder showing graduates' success. Give age, occupation, course preferred. Low tuition. Perry Schools, Brunswick, Georgia.

AIR Conditioning—Electric refrigeration. Rapid growth creates big demand for trained men. Earn up to \$35-\$50 weekly. Write for free facts. Utilities Engineering Institute, 404 North Wells, Dept. 102, Chicago.

For An extremely profitable lifetime business, operate a collection-credit agency. Free folder. Cole Associates, Dept. M, Syracuse, N. Y.

LEARN Beautiful penmanship—Inexpensive course. Hotel School, 36 Paulding, Tarrytown, New York.

WATCH Repairing is steady profitable work. Experts usually in demand. You can learn watchmaking trade at home, spare time. New original instruction system. Script engraving course included. Write for free details today! Nelson Co., B-2001 Manhattan Building, Chicago.

FREE—Vocational students' magazine. Forrester Miller, 462 Berwick, Easton, Penna.

HOME Study for degree—Psychology, Metaphysics, Bible, Philosophy. Free catalog. College of Universal Truth, 20 East Jackson, Chicago.

BECOME Practical scientific investigator. Modern illustrated course. Thorough training by former agent U. S. secret service. Particulars free. International Secret Service Institute, PM-20, Hoboken, N. J.

LEARN Tree doctoring, be independent, healthy and prosperous. Practical training. Van Yahres, Westbury, New York.

1940 GOVERNMENT Jobs. Many appointments expected. \$105-\$175 month. Prepare immediately, at home. List positions free. Write today. Franklin Institute, Dept. A3, Rochester, N. Y.

SUMMER And winter hotel positions. Beginners instruction courses. Write Lee Institute, 30 Huntington Avenue, Boston.

DRUM Major fancy spinning. Send \$1 complete lessons. Barth, 3537 Winthrop, Indianapolis.

MATHEMATICS. Sciences, drafting, blueprint reading, architectural, airplane, mechanical, electrical, ship, structural, building, estimating, engineers' licenses. Mondell Institute, 230 West 41st, New York.

DRAFTING Jobs. \$175.00-\$500.00 month. Quality now. Details free. Monroe Institute, PM-102, Alton, Illinois.

NEWSPAPER Jobs. Learn practical reporting, freelance journalism from experienced editors, by mail. The Millers, 10, Bakersfield, California.

BE A dental laboratory technician. One year course. Write Ohio School for Mechanical Dentistry, 811 Prospect, Cleveland, Ohio.

BECOME Trick cartoonist. Illustrated catalog 10c. Balda, Cartoonist, Oshkosh, Wisconsin.

GOVERNMENT Engineer draftsman examinations. Mondell Institute, 230 West 41st, New York.

ELECTRIC Welding pays good money. Jobs everywhere. Our short course trains you. Write for information. Welding Company, 4100 Paul Street, Philadelphia, Penna.

CLAIM Adjusting. Excellent pay. Investigate tragic accidents, fires; outwit fraudulent claimants. Burns School, Keystone Building, Pittsburgh, Penna.

BIG Pay trades you can learn in a few weeks. Decorating, paperhanging, graining, marbling, card writing. Enroll now. Booklet free. Chicago Painting School, 102 West Lake Street, Chicago, Illinois.

HOW To secure a gov't job in the classified civil service. Railway postal clerk, \$1900 a year. Postal clerk, city mail carrier, \$1700. Other jobs, \$1260 to \$2100. Our method helps you pass exams. Men-women, age 18 to 50. Send for free book. Patterson School, 8C Mercantile Bldg., Rochester, N. Y.

MASSAGE. Hydrotherapy, dietetics, drugless therapeutics, chiropody, taught by mail. Evans Correspondence School, Montgomery, Ala.

LEARN Auto mechanics, body, repairing, welding electricity, refrigeration. Diesel. Stevenson's, 2008A Main, Kansas City, Mo.

TELEGRAPHY Taught thoroughly. Railroad retirement act creating opportunities for new operators. Expenses low. Catalog free. Dodge's Institute, Hiatt Ave., Valparaiso, Ind.

SECRET Investigation. Experience unnecessary. Detective particulars free. George Wagner, M-2640 Broadway, N. Y.

START Plating business at home. Amazing profits. Make your own outfit. Inexpensive. Illustrated plans and complete instructions 50c. Popular Mechanics Press, 200 East Ontario, Chicago.

PLAYS, STORIES, MANUSCRIPTS

STORIES. Novels revised and typewritten for marketing. Welton Tinney, Winnsboro, Texas.

CARTOONING, COMMERCIAL ART, SHOWCARD WRITING, SIGN PAINTING

LEARN Chalk Talking. Quick, easy method. \$2.98. Marland Haines, Bloomfield, Indiana.

AMATEUR Cartoonists. Earn cash at home, copying advertising cartoons. Ad-Service, Argyle, Wis.

LEARN Cartooning for profit. Leon Gray School, Box 1901, Dallas, Texas.

CARTOONING. Sketching, etc.—46 lessons, 600 illustrations, including drawing paper, pens, pencils, \$1.00 complete. Fraba Service, Cashton, Wisconsin.

FOUR Color automatic pencil. Writes red, blue, green, black. \$2.00. Satisfaction guaranteed. West-Shore Novelty Co., 370 Beach St., West Haven, Conn. (PM).

ANIMATED Cartooning home course prepared by former Disney, Fleisher artist \$10. Mondell Institute, 230 West 41st, New York.

EARN Money making signs, posters, show cards with my new machine. Matthews, 2325 Cass, St. Louis, Mo.

ART Magazine including directory art books—free! Send 10c postage. Art Headquarters, Doty Street, Madison, Wisconsin.

PEN And ink drawings. Let us draw your advertising and catalogue illustrations, from photos, copies or objects. Best work and fair prices. Heraldic Studios, 1914P Oakdale Avenue, Chicago, Ill.

ADVERTISING AGENCIES, LETTER WRITERS, FOR ADVERTISERS

ADVERTISE Profitably: \$15 reaches 5,000,000 Sunday newspaper readers with 24-word ad. Newspaper, magazine, mailing-list ratebook, free. Chicago Advertising Agency, 20-PA West Jackson, Chicago.

LEARN Advertising at home. Easy practical plan. No text books. Common school education sufficient. Interesting booklet and requirements free. Page-Davis School of Advertising, 3601 Michigan Avenue, Dept. 3439, Chicago.

ADVERTISING Ideas, slogans, phrases, 500—25c. Daniels Press, South, Statesville, N. Car.

LETTERS Written for jobs. Also sales letters and advertising copy. Business Counselor Institute, 122 South Michigan, Chicago.

40 WORDS Displayed, 65 magazines, 3 months, \$2.00. Lists. Hagley's, Box 2522, Portland, Ore.

DISPLAY Advertising: 205 newspapers, \$1.47 a rate line. Fidelity Advertisers, 3838-P Washington, Chicago.

"PROSPERITY" Pulls! 20 words six times, \$2. Sample free. Sizemore, 4917N Kostner, Chicago.

ADVERTISE: 24 Words, 149 newspapers \$6.50. Lists free. Advertising Bureau, 4515-C Cottage Grove, Chicago.

INCH Display advertisement 30 magazines, year \$24. Wood's Popular Services, Atlantic City, N. J.

ADVERTISING Placed all magazines, newspapers, radio. Lowest rates. Free service. 54 page rate book free. Baker Advertising Agency, A-189 West Madison, Chicago. Successors to Ankrum. Established 28 years.

FREE—New Advertisers Rate Guide, 44 pages. Includes everything. Lowest rates. E. H. Brown Advertising Agency, 140 S. Dearborn, Chicago.

ENLARGE Your own photos. Make money doing work for others. Build your own enlarger. 4 complete plans 50c. Popular Mechanics Press, Dept. C40, 260 E. Ontario St., Chicago.

BUSINESS SERVICE

COMMERCIAL Printing at lowest prices. Samples. Modern Print, 6 Forest Place, Fredonia, N. Y.

WE Will act as your representative in New York City—business, legal, buying, selling, unusual. Strictly confidential. Lederman & Sobel Co., 1700 Longfellow Ave., New York City, N. Y.

WASHINGTON, D. C. mail-reforwarding address. Hawkins Mail Service, 817 Fourteenth.

COLLECT Your bad debts. Merchants write Lament Company, Beacon, New York.

RUBBER STAMPS AND OFFICE SUPPLIES

DEEP Letters! Two lines 25c. 3—35c. Adcrafts, Lacrosse, Wis.

CUSHIONED 3 Lines 35c. Stamp-Works, Box 402, Youngstown, Ohio.

2 LINES 25c. 3—35c. Cushioned. Stamp Works, Centerport, N. Y.

ORIGINAL. Cushion mounted. One, two lines, 25c; three 35c; four 45c; facsimile signatures \$1.50. Stamp Works, 314 Bradley, Peoria, Ill.

2 LINES 25c, 3 Lines 35c, Stamp Works, Auburn, Nebr.

TYPEWRITERS, DUPLICATORS, OFFICE DEVICES

DUPLICATORS. Staplers, postal scales, labels, stencils, ink. Money saving prices. Write DixieGraph, King, North Carolina.

NEW \$3.75 Automatic adding machine. Fully guaranteed. Bassett, Box 302-A, Altadena, California.

TYPEWRITERS. Adder, mimeograph, multigraph, addressograph. Send for free lists of machines that will help you at half price. Pruitt, 28 Pruitt Bldg., Chicago.

INCREASE Business now. "Excellograph" Rotary Stencil Printer reprints thousands everything you typewrite, hand-write, draw or trace. Colors, \$19.75 to \$44. Terms. Illustrated literature free to business or professional men. Pittsburgh Typewriter Supply, Department K-2, Pittsburgh, Penna.

PRINTING, MULTIGRAPHING, MIMEOGRAPHING, GUMMED LABELS

BOOKS On all engraving and printing processes, offset, art, photography, silk screen, block cutting, etc. List free. Commercial Engraving Publishing Co., 340 North Ritter Ave., Indianapolis, Ind.

UP To date printing. 125 8x11 letterheads and 125 6 3/4 envelopes high grade white stock. \$1.00 postpaid, quick service. McConnell's Press, 411 N. Gilbert, Danville, Illinois.

6x9 CIRCULARS. Envelopes, letterheads, postcards, \$1.89 quantities. Typewriter letters, slips, labels lowest prices. Samples. Goodprint, Harrisonburg, Va.

125 8 1/2 x 11 BOND Letterheads and 125 envelopes. Business, personal, professional. \$1.00 postpaid. Bennetville, 997 West Roosevelt, Philadelphia.

500 TWO-COLOR Stickers, 50c. Free catalog. Cott's, Spickard, Missouri.

500 8 1/2 x 11 LETTERHEADS. 6 3/4 Envelopes, \$1.00. 5000 \$7.50 printed. Carter, Box 52, Orange, Calif.

PRINTING—Lowest prices in America. Samples free. Pitz, Middle, Iowa.

1000 CIRCULARS 6x9, \$2.72. Samples, pricelist. Record Printing Co., Lancaster, Ky.

LETTERHEADS. Envelopes, statements, 1,000, \$2.75. Samples. Price list. Printrite, Baltimore, N. C.

1,000 TWO Color shipping labels, 4x2 1/2 —\$1.75. 10,000 3x6 circulars, \$4.95. Letterheads, envelopes, typewritten letters, cards, etc. Okayprint, Martins Ferry, Ohio. Samples.

1000 BOND Letterheads, envelopes \$2.25. Evers' Print Shop, Atmore, Alabama.

250 LETTERHEADS With 9" envelopes \$2.35; including return envelopes \$3.00. Hargett, 3646 Kosciusko, St. Louis, Mo.

BETTER Printing—Letterheads, 6 3/4 envelopes, cards, statements, 500, \$1.50. Franklin Printery, 2932 Pershing, Chicago.

150 LETTERHEADS And 150 6 3/4 envelopes \$1.00 postpaid. Printery, G-226 Madison, Pittsburgh, Penna.

BETTER Business, personal cards 250, 60c. Titsworth, Cornelia, Flint, Mich.

QUALITY Printing, lowest prices. Samples. Cheser, 3111 West Monroe, Chicago.

MIMEOGRAPHING. Printing. 250 letterheads 75c. Wickesser, Prospect St., Holyoke, Mass.

1,000 LETTERHEADS. Statements, envelopes, \$2.79. 5,000 \$9.95. 1,000 business cards \$1.49. H. Cotter, 2457 Seyburn, Detroit.

PARTICULAR? Neargrave Emboss-O! Distinctive, striking, different. Samples. Solldays, Letterhead Specialists, Knox, Indiana.

ABSOLUTELY Amazing! What? Our new plan! Samples. Adkins, Union, N. Y.

LETTERHEADS. Envelopes, statements, 250 \$1.00. Samples. Hamilton Press, 4341 P. Meade, Chicago.

HAMMERMILL Letterheads, any color paper, ink; 300 8 1/2 x 11, \$1.48 postpaid. 30 styles type. Free particulars. Woodruffs, 217A Lewis, Duluth, Minn.

1000 BUSINESS Cards \$1.00. Vellum, free cuts. Dixie Business Card Co., PM189 Jefferson, Memphis, Tenn.

200 6 3/4 ENVELOPES Neatly printed, \$1.00 postpaid. D. Matuska's, Girard, Ill.

1000 BUSINESS Cards post paid \$1.00. Superbo Print. Room 303, 815 So. Hill, Los Angeles, Calif.

1000 NEAT Business cards \$1.00 post-paid. Taft Co., Box 5366, Chicago.

50 SHEETS, 20 Envelopes, 25c postpaid. Western Stationery, Topeka, Kansas.

500 $\frac{3}{4} \times 2\frac{1}{4}$ FOUR Line gummed stickers, 25c. Moritz Printery, Saginaw, Mich.

1000 NOTEHEADS, Envelopes, each \$1.75. 4 lines. Zoeller, 5215 Gilmore, St. Louis, Mo.

PRINTING OUTFITS AND SUPPLIES

BARGAINS — Presses, type, supplies. Send stamp, 159 Harvard, Cambridge, Mass.

SIMPLIFIED Cut making. Inexpensive process \$1.00. Alta, 472 S. Chairty, Bethel, Ohio.

NEW Type 29c font. Catalog dime. Box 123E, Jackson, Michigan.

INEXPENSIVE Home-made press. Details free. Holman Brothers, Downsville, Louisiana.

PRESSES, New type that satisfies. Lists 3c. Landis, Richland, Penna.

PRESSES, Type, supplies. List free. Catalog ten cents. Model Press Co., York, Penna.

PRESSES, Type, cabinets, supplies, catalogue for stamp. Lincoln Press, 220-C Hartwell, Fall River, Mass.

CARD Printers' special—Complete font (196 pieces) 14 pt. wedding text type only 50c. Republic, 7150 Cottage Grove, Chicago.

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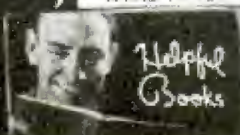
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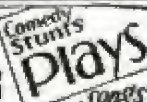
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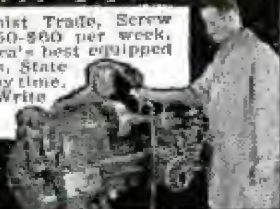
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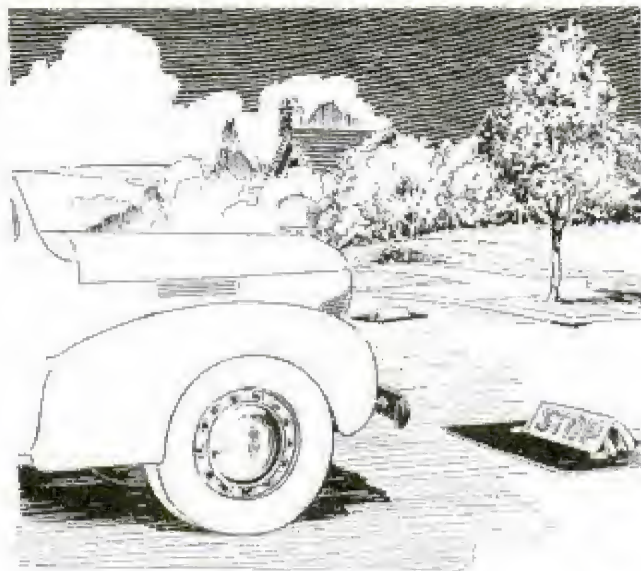
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POPULAR INVENTIONS

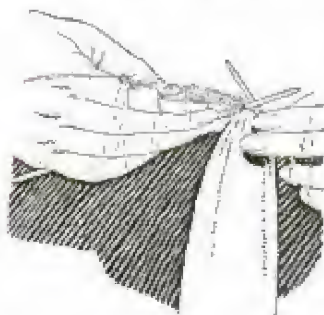
(Continued from page 35A)

SOMETHING new in traffic control signals is offered in a "stop" sign patented recently. The signal is mounted in a base which is sunk into the roadway. It



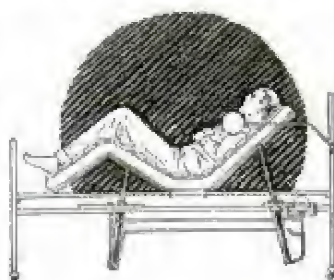
remains at an angle of about forty-five degrees, fully visible to the motorist, until the wheels of the car strike it, forcing it downward into the base. After the car has passed, it returns to its original elevated position.

MECHANICAL aid for the knitter is offered in the form of a newly patented ring that slips on the finger and that controls feeding of the yarn to the needles. The ring is used on the index finger. A tension clip located between the feed loop and guide coil



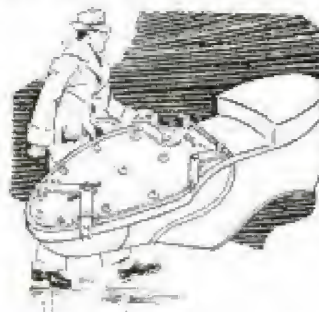
maintains the proper tension on the yarn.

COMFORT for the patient is the objective of an accessory for a hospital bed, patented recently. A supplemental frame for the bed frame consists of pivotally connected sections, with means of elevating certain sections to raise the head and



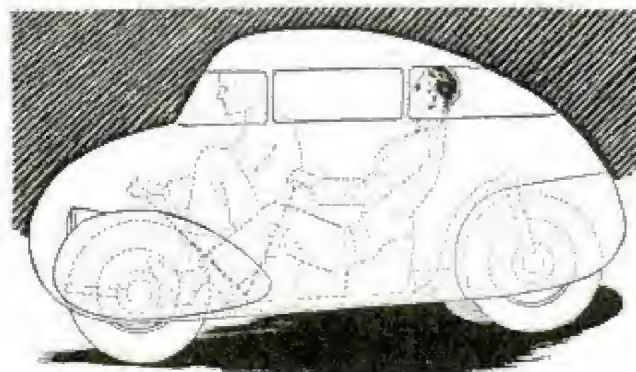
the knees of the invalid. A number of positions, from full reclining to half sitting, are possible with the mechanism.

SLIPPING on the ice or other slick surface may be reduced by a newly patented non-slip attachment for the shoes. It includes a calked plate with a pair of arms mounted on a pivot and shaped so that their outer ends clamp the edges of the shoe.



Other clamping means are provided at the rear of the plate for firm attachment just forward of the instep.

DESIGNED for sport, resort use and possibly in places where the supply of gasoline is restricted, a man-powered vehicle has been patented. It is intended for occupancy by two persons. A wheel is used for steering. An operating lever is mounted on the car's framework for oscillation in a vertical plane. When the lever



is oscillated, it causes the driving mechanism to turn the wheels and thus propel the vehicle. A braking system also is incorporated into the car, which is complete with sedan-like body.

Due to the fact that many of the devices described in this department are still in the patent office stage and are not on the market, Popular Mechanics Magazine cannot undertake to supply further information regarding them.

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"How does **COOLNESS** rate with you in pipe tobacco?" *we asked in a drafting room...*



COOL BURNING
MAKES A WORLD OF
DIFFERENCE IN
PIPE-SMOKING.
PRINCE ALBERT
TAUGHT ME THAT. IT'S
SO MUCH **MILDER!**

COOLNESS COMES
FIRST WITH ME, TOO.
THERE'S NO BITE IN
COOL-BURNING P.A.,
BUT THERE'S **PLENTY**
OF **RICH TASTE**
AND **AROMA**

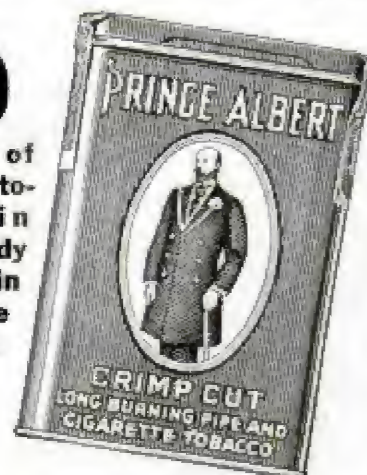
A **COOL SMOKE** IS A
MELLOW, DELIGHTFUL
SMOKE, THANKS TO
PRINCE ALBERT'S
CHOICE TOBACCOS

In recent laboratory "smoking bowl" tests, Prince Albert burned

86 DEGREES COOLER
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UP goes the pleasure of pipe-smoking when burning temperature goes *down!* There's no excess heat to bite the tongue and flatten out flavor and aroma. **COOL-SMOKING** Prince Albert opens the door to **TRUE MILDNESS** and **MELLOWNESS** with **PLEASING TASTE** — the topmost joys of choice tobaccos. "No-bite" treated for *extra* smoothness. "Crimp cut" to pack and draw *easier*. In a pipe (and a "mak-in's" smoke, too) you'll simply be delighted with P.A.!

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Albert



Prince Albert

Copyr., 1939, R. J. Reynolds Tob. Co., Winston-Salem, N. C.

THE NATIONAL JOY SMOKE

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WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 73

FEBRUARY, 1940

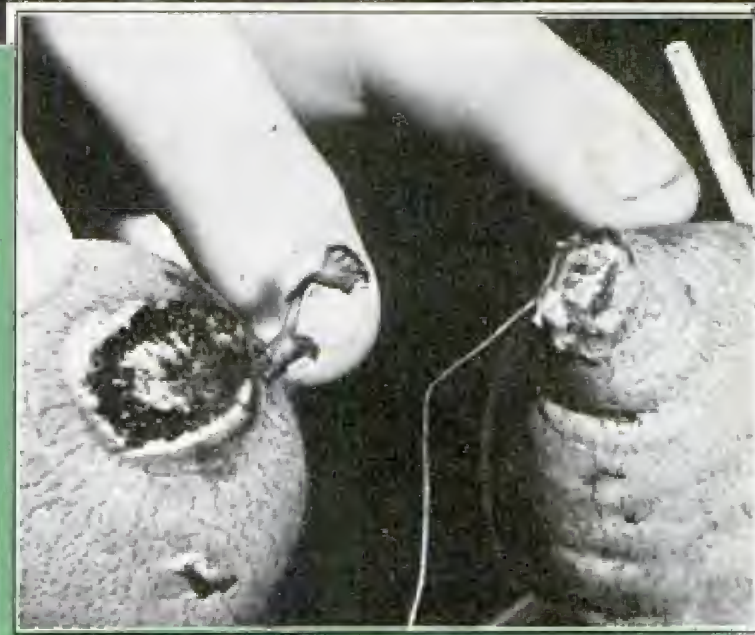
No. 2

WONDER "FOOD" for PLANTS



VITAMINS, those wonder-working chemicals, are performing seeming miracles in the plant world, miracles that may revolutionize horticulture, and that have already opened up undreamed of possibilities for the amateur gardener.

Imagine transplanting delicate shrubs with practically no shock or set back, growing shade-loving plants in bright sunlight, returning dying plants and trees to health in a short time, growing huge blooms. Yet all these things are possible for even the rankest amateur gardener, and the only equipment needed is an eye dropper, a measuring jar, a watering



Top, glloxinias planted at same time. One at right was given vitamin treatment. Bottom, vitamin-treated sweet potato (left) grew leaves; one at right, placed in water, grew only roots



Top, vitamin stimulation of root growth illustrated in heavy matting of coleus. Center, in transplanting, roots are placed in solution and dirt removed. Bottom, roots are soaked for twenty minutes, then replanted and watered with heavy concentration of vitamin solution

pot—and a pinch of white crystals.

Those crystals are pure vitamin B₁ which a short while ago began working wonders in the laboratories of the California Institute of Technology. It all started when plant physiologists at the institute began experimenting with the vitamin as a stimulant to root



Vitamin spray gun which automatically mixes 250 gallons of working solution

growth. Soon it became clear that the largest field was in connection with garden flowers and shrubs. For mysterious reasons many ornamental garden plants failed to manufacture sufficient quantities of this vitamin. Most commercial and food crops, however, were found to produce all of the vitamin they could use.

Concentrating on the roots of garden plants, the scientists made thousands of experiments. Minute sections of roots were treated with the vitamin. Rigid precautions were taken to prevent contamination from outside sources. Water in which the roots grew was double-distilled in pure glass stills to prevent contamination from copper pipes. All instruments were thoroughly sterilized and the experimenters used glass screens to deflect their breath from the roots being treated.

Plant Culture Supply
165 N. Hill Ave

Gradually it became apparent that although the primary function of the vitamin was to stimulate root growth, it also had a reaction on the stems and foliage of many plants, increasing their size and the speed of growth.

Furthermore, it was discovered that by treating the bare roots of many plants with a heavy concentration, "root shock" could be greatly reduced. Root shock may be compared to the surgical shock which accompanies major operations. Removing a plant from the ground, changing its environment, breaking many of its roots and bruising others, is a pretty major operation as far as the plant is concerned. The result is that it droops, loses its leaves, often dies.

However, if the bare roots of the plant are soaked for a few minutes in B₁ solution, this shock is practically eliminated. Delicate bougainvilleas, which are normally very difficult to transplant, have, after this treatment, been transplanted in hot sunlight. The plants showed no ill effects, whereas control plants which had not received vitamin treatment drooped within a short time.

From the laboratory, experimentation next went into the stage of practical tests. Amateur and



Top, laboratory worker wears sterile cap and uses glass screen to protect plant roots from breath contamination. Center, lemon tree cuttings after five weeks in sand. One at right was fed water, next one was fed indole acetic acid (another wonder chemical) and one at left was fed the acid and vitamin B-1. Note that vitamin-treated cutting has heavy root mat. Bottom, left, how sweet potato is placed in water or solution. Right, using eye-dropper to add one drop of vitamin to one gallon of water

Nov. 1937
 C. C. Austin
 Rockledge, Fla.



Climbing rose, treated with vitamin, is three times the size of untreated rose planted at same time. Bottom of page, left, all the equipment necessary for vitamin experiments—vial of the crystals, vial for mixing stock solution, eye dropper and a toothpick. Right, tiny amount of vitamin (compared with fingertip) is enough to make twenty gallons of solution

professional gardeners in Pasadena, Calif., conducted many experiments. The results were amazing.

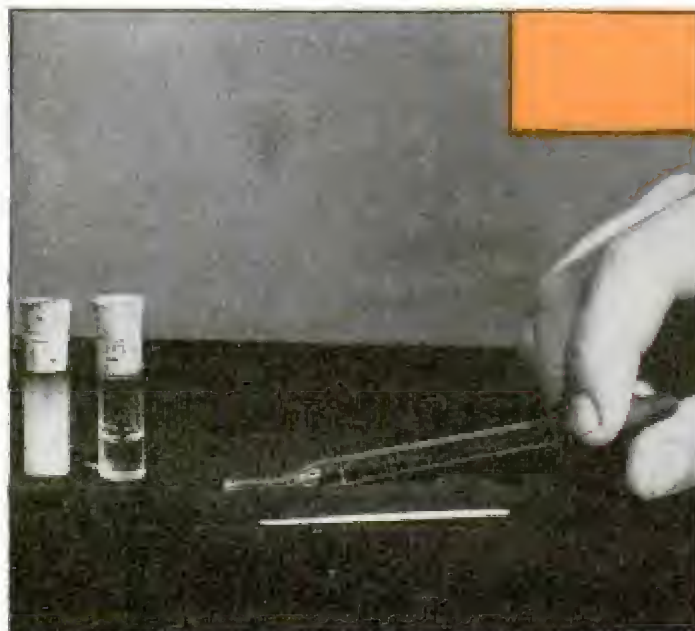
A camellia cutting grew into a fourteen-inch shrub in only eleven months. A narcissus grew to a height of forty-five inches. Vitamin-treated rose bushes grew as if by magic, while untreated ones beside them remained weak and scrawny. In one large rose garden half the shrubs were vitamin treated and half not. The line between the treated and untreated shrubs was as clear

cut as if a magician had touched those on one side with his wand and commanded them to grow.

While the amateurs were achieving such startling results, vitamin treatment began to prove of commercial importance. Although it apparently has no effect on most food crops, it profoundly affects many types of shade and fruit trees. It was tried experimentally on a few trees in an orange grove. Other trees were left untreated as controls. Within a few months, the vitamin-treated trees showed such advance that the idea of controls was abandoned, and all the trees were treated. As the grower

said: "The experiment was such a success that I felt I couldn't afford to let any of my trees go without the vitamin."

One day a shade tree on a Pasadena street was "gassed." The tree was an extremely valuable specimen which had been brought from Tibet. The gassing was caused when a main broke, allowing deadly fumes to seep among the roots. The tree wilted, all the leaves fell. Desperate measures were taken to save it. None of them worked. Just before the tree was given



up for dead, some one thought of vitamin B₁. Hundreds of gallons of vitamin solution were poured around the tree. It was saved.

Two weeks after gigantic eighty-foot palm trees were planted around the new Los Angeles union station, a gale whipped the trees to ribbons. Some were damaged so badly that leaves refused to grow. The trees looked more like telephone poles than palms. Just before they were to be dug up, it was decided to try vitamin B₁. Two hundred gallons of the solution were given each tree. Three months later the palms swayed in the sky, green and healthy.

Such results seem almost uncanny, and yet the methods of using and experimenting with this wonder chemical are so simple that any one can apply them in his own garden. Following are the simple directions:

For equipment all you need is a watering can which holds a measured amount. A two-gallon can is preferable, but a one-gallon size will do. It is difficult to measure a small enough quantity of the solution for any can of less than one gallon capacity. Besides the watering pot, you will need a clean eye dropper (one that forms drops accurately), a small vial to hold the stock solution—and a supply of vitamin B₁ which should be pure synthetic crystals. Your drugstore probably has or can get the pure synthetic crystals. Should you have any difficulty securing them locally, they may be obtained from George C. Warner, Pasadena, Calif. Enough of the vitamin to make 2,500 gallons of solution costs only two dollars. For spreading the solution over large areas, a spray gun which attaches to the hose and automatically measures the solution is helpful.

To mix a stock solution, take only enough crystals to cover the head of a pin. This is approxi-

(Continued to page 145A)

Bed in "Minute Man" Design Is Decorated with Muskets



"Minute man" plaque at the foot and old-time muskets trimming bed posts and headboard form war theme in design for bedroom

World events have influenced the decorative scheme of new home furnishings which bear designs commemorative of an important phase of American history. In one bedroom suite guns of early days trim the bed posts and headboard, and a plaque at the foot portrays the "minute man."

Parking Airplanes on Their Noses Saves Space in Hangar

When storage space in a hangar at the East Boston, Mass., airport became overcrowded the problem was solved easily enough by parking the airplanes on their noses. Fifteen light planes could be stacked, tails in air, in the floor space ordinarily occupied by five or six ships. The propellers were protected by resting them on wood blocks.



Planes stacked on their noses in East Boston hangar occupy only a third the space they formerly required on the floor

251 & Catalina

Wiggins Airways

Massachusetts Airport

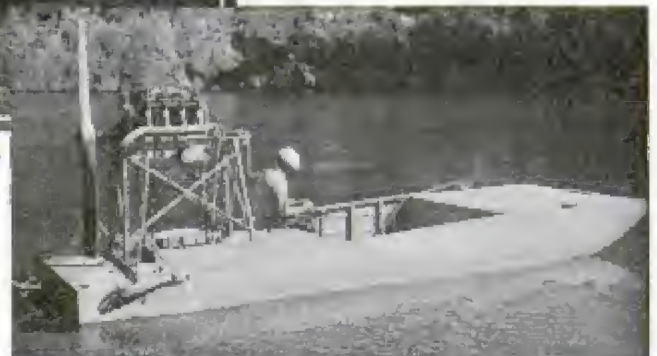
Fast Air-Propelled Boat Glides over Shallows

Pushed by an air propeller, a boat has been built to skim over shallow water and cross sand bars which an ordinary boat is unable to navigate with ease. It is used by the bureau of reclamation for its work on the Colorado river below Boulder dam, and has proved to be even more efficient in rapids or moving water—going either up or downstream—than it is in still water. At full speed, which is estimated to be twenty-five miles an hour, the boat has a draft of two and one-half inches, and the rudder kicks up automatically when striking obstructions.



Photos, U. S. Bureau of Reclamation

Air propeller at rear enables boat to navigate shallows and rapids below Boulder dam where other craft would run afoul sand bars. Right, engine and propeller mounted high above deck



Steel-Hearted Aerial Camera Carries 500 Feet of Film

Its heart of steel unaffected even by stratosphere temperatures, the latest of aerial survey cameras can go up into the sky with a full day's load of nine-by-nine inch film and map the earth for three to five hours without taking time out to reload. Mounted in the floor of a glass-walled "Explorer" plane, its operation is made convenient and accurate by a bubble level on the trig-



Mapping plane and aerial cameras; that in inset carries 500-foot film

ger and a stop watch, number recorder and film gauge on top of the camera where they can be seen and used easily. The camera carries a 500-foot roll of film, taking 650 pictures. The heart, including focal plane and lens, is of Invar steel which will not contract nor expand within a 300-degree range of temperature and so permits mapping from great heights.

Stainless Steel Plate Applied to Iron at Low Cost

Ordinary iron can be given a coating of stainless steel by a recently patented process at prices well below the cost of solid stainless steel. In applying the coating over ordinary low-carbon steel, carbon arc welding is used, and it is said the cost is comparable with that of ordinary steel.

Anti-Aircraft Searchlight Unit Has 'Outrigger' Guide Wheel

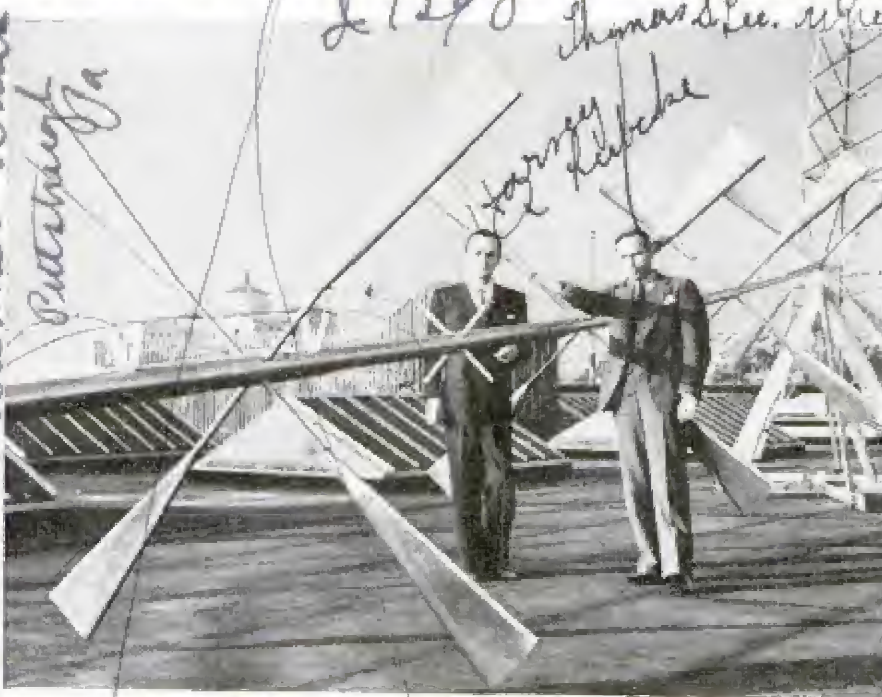


Gas-masked searchlight operator practices maneuvering the big "eye"

Dotting the English countryside are far-sighted searchlights ready to reach out into the night sky and spot enemy aircraft on forays over the island. Mounted on a swivel truck with chain treads, the light can be maneuvered easily by a geared steering wheel at the end of long steel arms.

"Paddles" on Antenna Pole Sharpen Television Signals

To obtain greater definition in television pictures, a Hollywood transmitting station is trying "paddle" antennas on a sixty-foot pole. Four of these quadruple paddles are stacked at intervals along the vertical pole, which is installed on a roof top so that the horizontal paddles can spread signals over a wider ground area.



Flaring paddles are intended to widen distribution of television signals

¶ Six fires break out every five minutes in the United States, inflicting losses that totaled \$265,000,000 in 1938.

Filmer's Friend
Record. Nov. 1930.

8 1230 Piper Aircraft Corp. Wayne, Mich.
Stinson Aircraft Corp. Wayne, Mich.



IT'S EASY *to* FLY YOUR OWN



you get a complete flying course free if you purchase one of the "flivver" planes. Should the flying course be taken without buying a ship, the cost will range from \$250 upward. This includes eight hours of dual instruction and thirty-five hours of "solo" work, flying the plane alone, becoming familiar with the appearance of the ground from aloft and well-versed in airport signals, weather reports, maps and the like. Then, after a written exam-

By Julian Leggett

FLYING your own airplane, once only a dream to the average American because of the expense, now becomes possible for anyone with \$1,000 to spend.

You need not have that amount in cash. A lightweight plane, approved by the government for safe-flying characteristics, can be purchased for one-third down, about \$350, and the balance in twelve to eighteen months, around fifty to seventy dollars per month, depending upon the length of the contract. That amount includes insurance and financing fees.

Learning to fly was too expensive for the average person not so long ago, but today



Pilot's compartment of the Stinson 105 (top); instrument panel of a Piper Cub (center), and testing vibration of tail unit in Piper factory



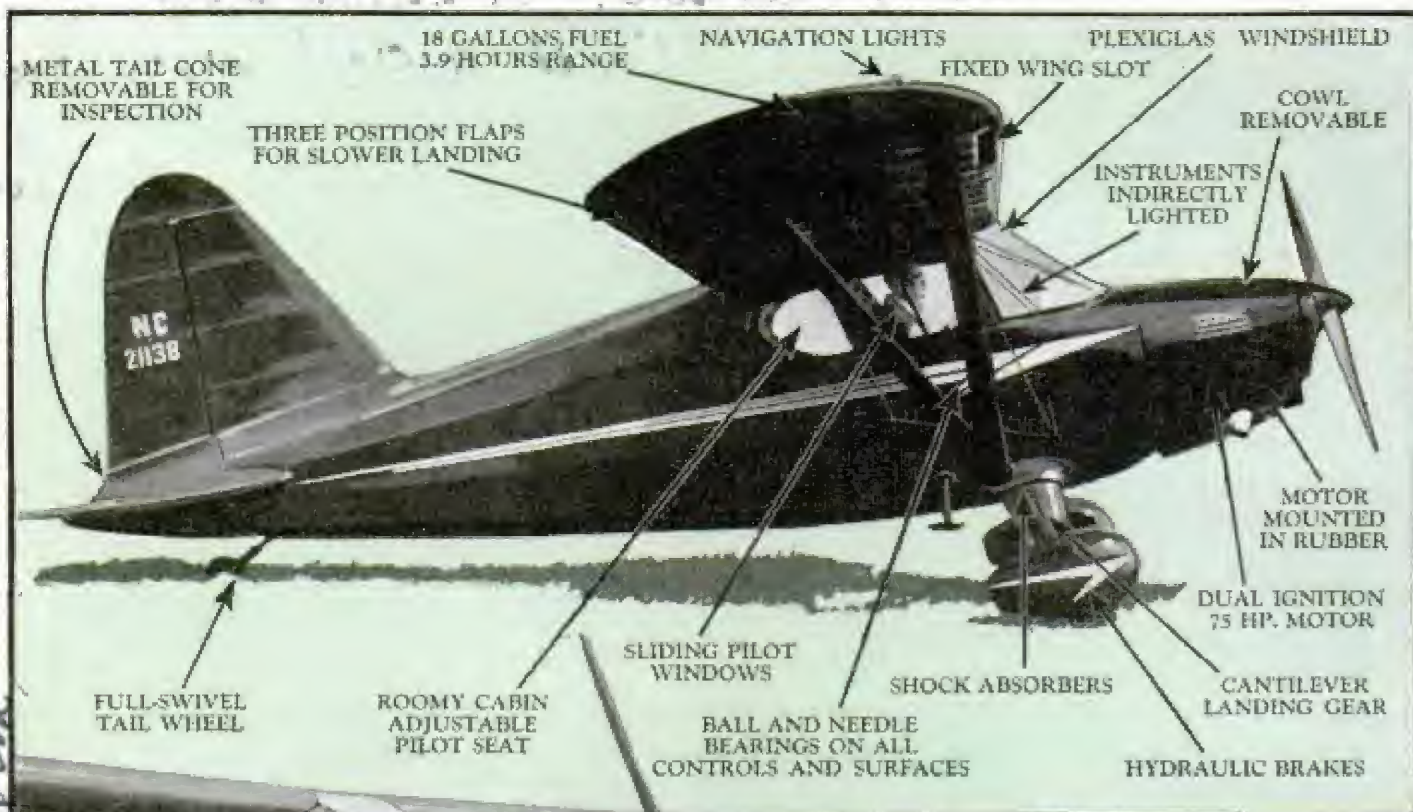
ination on laws and regulations and a thorough flight test, the pilot is granted a license by government inspectors—if he passes all tests.

Operating and maintaining a plane also was out of the question for the person with a moderate income a few years ago, but the lightweight plane costs its owner even less to fly and keep in good condition than does a



Stinson 105 (top); group of pilots conferring on course for cross-country flight in three light planes (center), and eighteen men seated on wing of Piper Cub test the ship. They weigh 2,700 pounds

Pennsylvania Colorado
~~\$945.00 w/o.~~



\$75; maintenance (inspection), \$5; total, \$294.25.

This amounts to 2.94 cents per mile. As more flying per year is done, the cost per mile decreases. Many Cub owners and operators attain a considerably lower cost, depending upon expenses in their territory.

Hangar rental depends largely upon the locality in which the

Stinson 105, with arrows indicating essentials of this 75-horsepower ship (top). Federal inspector examining a Cub just before it leaves factory (center). Aeronca seaplane powered with 65-horsepower engine

medium-priced automobile, if both are operated over comparable distances. Then the saving in time on long trips is an extra dividend accruing to the owner of the plane, because he encounters no traffic and no speed limitations.

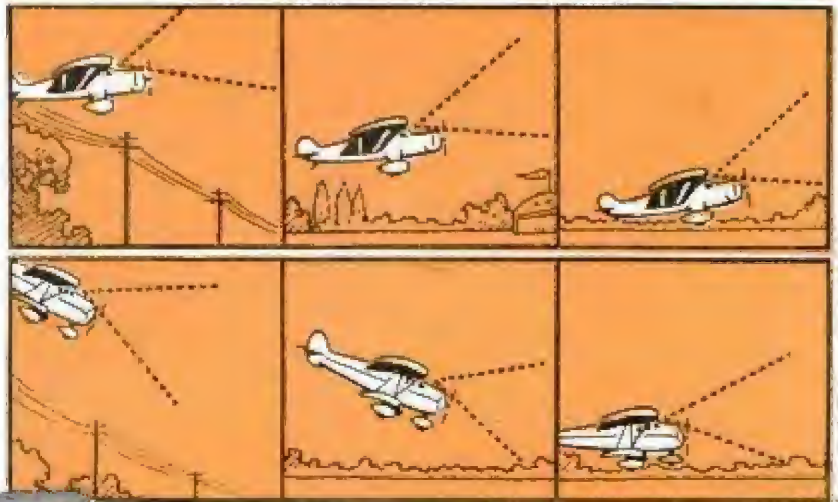
Costs of flying and maintaining a plane of the Piper "Cub" type, powered by a forty-horsepower engine and capable of cruising at seventy-five miles per hour, may be figured like this, for 10,000 miles in the air the first year: Depreciation, \$107.25; gasoline, \$100; oil, \$7.20; hangar,



plane is to be used. Storing your ship in a city airport hangar will cost ten to fifteen dollars per month, but near a small town the cost is less, perhaps five dollars per month. Some owners simply store their ships under a shed in a pasture, while others stake them in an open field. One recommended plan is for the purchaser of a lightweight plane to buy a storage shed, paying nine or ten dollars per month until the purchase is completed, so that hangar expense will be eliminated in a short time.

Maintenance is another item that may vary, but it should not amount to more than sixty dollars for the first 300 hours, or about 22,000 miles of flying. The Civil Aeronautics Authority requires inspection every 100 hours of flying. Any repairs found necessary must be done before the plane takes the air again. Usually the third checkup reveals a condition requiring an expenditure of thirty to fifty dollars for labor and parts, although some planes have been operated 1,000 hours before a major repair job became necessary. Lightweight planes and their engines are so well constructed that they can be operated into the hundreds of

(Continued to page 146A)



Refueling fifty-five horsepower Cub in midst of its record endurance flight of 535 hours 49 minutes (top); sketch showing difference between landing with standard gear (upper panel) and with tricycle gear (lower panel). Bottom, Waco "N" coming in to land. Note tricycle gear

Waco Aircraft Co.
1rm Phil

Robert A. McDaniel
Murray
Vernon J. Baxter

"Ear Mask" Guards Welder from Flying Sparks



Metal screen in ear guard shuts out flying sparks from welding but does not interfere with hearing

Since flying sparks are dangerous to the ears as well as to the eyes, an ear guard for welders has been put on the market. Made of sponge rubber, the ear guards weigh only two ounces. A metal screen guards the opening of the ear.

Six-Cup Tray of Ice "Cones" Serves One at a Time

Ice in the form of truncated cones instead of the usual cubes can be frozen in a six-cup rack for the household refrigerator. Each cup is covered to keep out odors, and a projection inside each cover grips the ice cone and removes it without the



The housewife can remove one cone of ice at a time from its cup without melting the entire tray

necessity of thawing. Thus individual cones may be removed without disturbing a trayful. Freezing is rapid because of the large area in contact with the cold air.

Tire Has One White Sidewall While Other Is Black

Automobile tires with the outer sidewall white and the inner wall black are introduced this year as a money-saver for those who like the dressy white tires. Less expensive than the tires with two white sides, the black-and-white tires can be turned about when the white face becomes soiled, exposing the conventional black surface. Because of the tendency of dirt and grease to collect on the inner side of the tire, the double-white tires could not be reversed.

Milled Slots in Nose of Pliers Help Remove Snap Rings

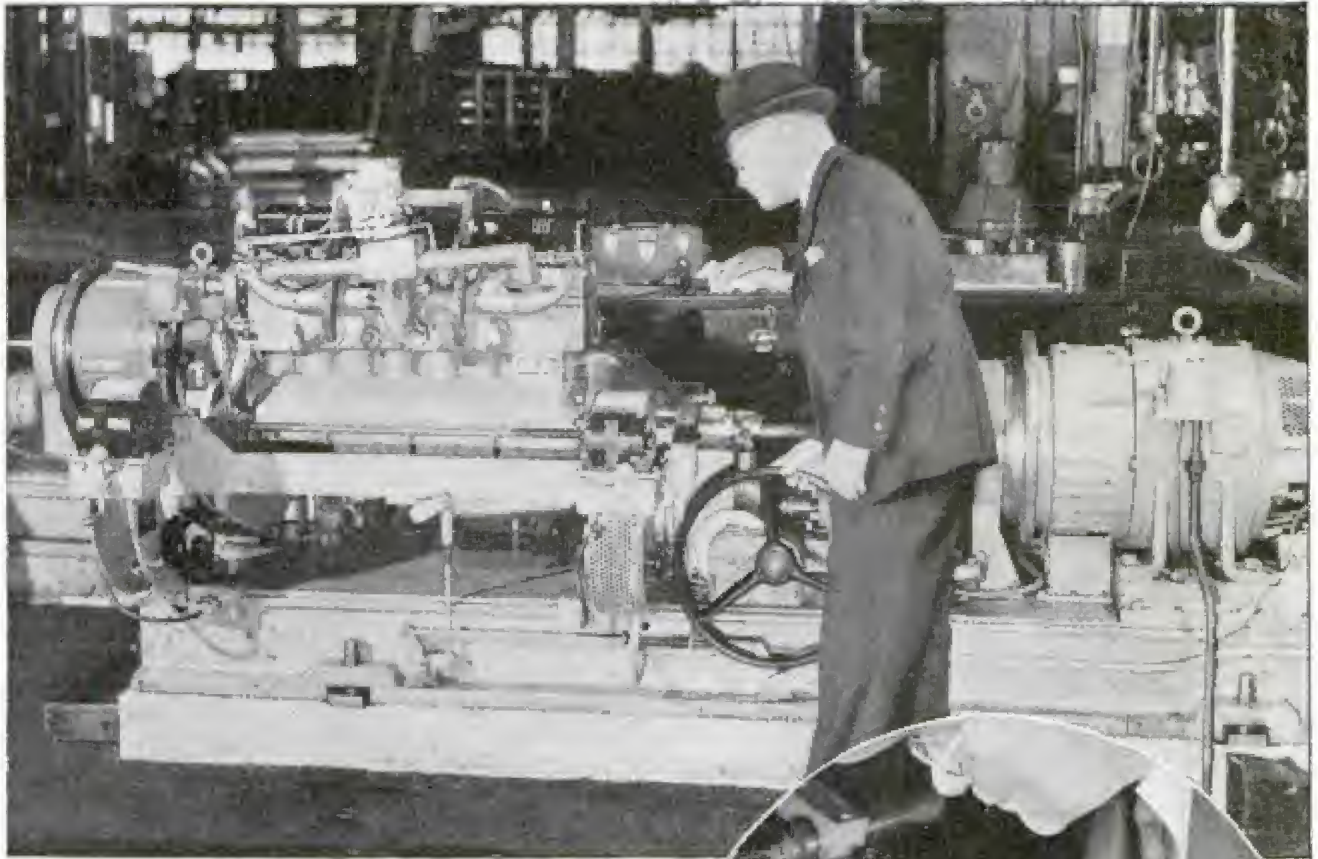


Pliers inserted at split section of snap ring force it to spread open for quick and easy removal

Snap rings used for retaining bearings and gears in trucks and tractors—hard to remove with ordinary tools—can be slipped out easily with special pliers that have two milled slots to engage the ring points and spread them. It takes only a minute for a mechanic to lift out the contracting type rings with the new pliers, which may be purchased separately or in a set including wedges used for removing expanding rings.

Watsona Tools
Watsona, Tenn

Engine Balancer Flashes Image of Vibration



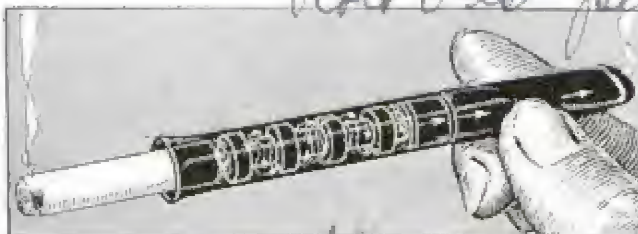
Vibration is detected and its wave image flashed on a screen by a new engine balancing machine now in use at the Buick factory. It does not, however, correct for vibration caused by faulty ignition, carburetion or other uneven firing. The machine consists of a bed for mounting the assembled engine and a fifteen-horsepower electric motor which is used to drive the engine through the speed range where vibration occurs, a vibration indicator whose operation depends upon the projection of a beam of light on a screen to reveal the image of the vibration wave, and an electric drill for drilling the flywheel at the correct location as determined by the vibration indicator, thus restoring the engine's balance. The depth of drilling is determined by the amplitude of the vibra-



Top, engine on testing machine. Circle, examining the vibration indicator during test

tion wave. By means of this machine, an engine may be balanced to within three-eighths inch ounce, which is equivalent to the weight of a dime on the flywheel.

Condenser in Cigarette Holder Filters, Cools and "Dries" the Smoke

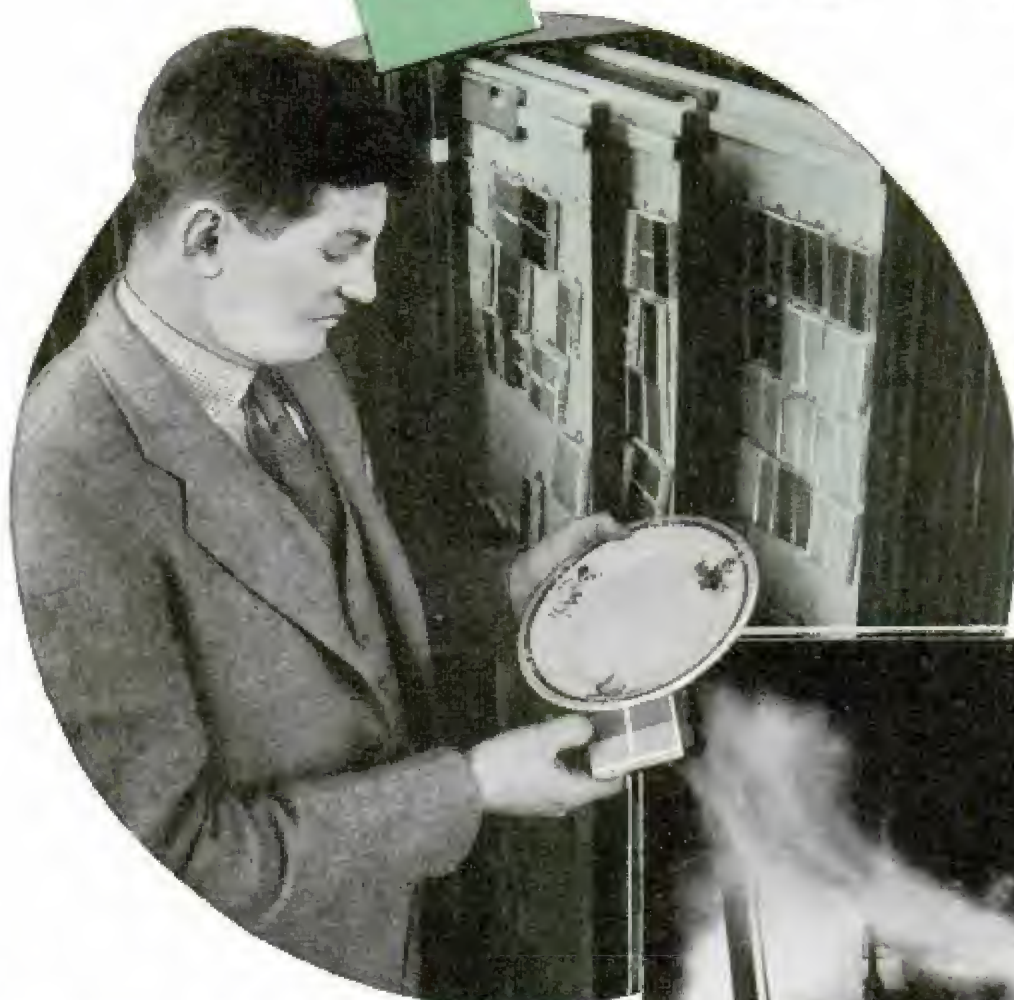


Smoke is given a circuitous course through a patented cigarette holder that acts as a condenser, which does the work of a filter by trapping impurities, while also removing moisture from the smoke and cooling it. The condenser may be removed from the mouthpiece for frequent cleaning.

Aschwood Pipe Co 1343 N St N.W.

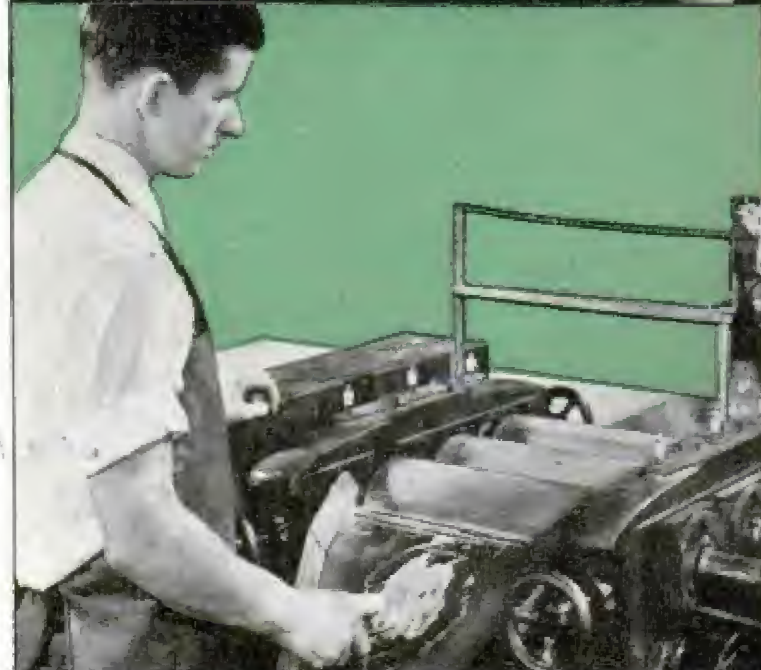
21349

UNCLE SAM



Fired samples of standard colors (top) are kept on file in ceramic color plant of the du Pont company to facilitate matching of any shade submitted. Gas generator blasting directly to the air (center) in process for removing unnecessary gases in production of synthetic ammonia and synthetic alcohol. Steel roller ink grinding machine (bottom) grinding pigments for printing inks

Belle



WHEN newspaper "extras" told of the outbreak of the war in Europe in 1914, few in the United States realized the extent of the threat to industry and employment in this country which was to follow the firing of the first gun.

Last year, guns again roared overseas, but hardly a disturbing ripple was noticed in industry.

Why the difference?

The answer is given by Lamot du Pont, president of E. I. du Pont de Nemours & Company.

"Then, Mr. du Pont says, "numerous industrial activities were dependent upon imports. Employment of millions of our workers was threatened. Even the health of our people was endangered, because the importation of many important medical supplies had been cut off. Conditions bordered on panic.

"Today, in sharp contrast, every im-

Wilmington, Del

*Technical Laboratory
Inventive work*

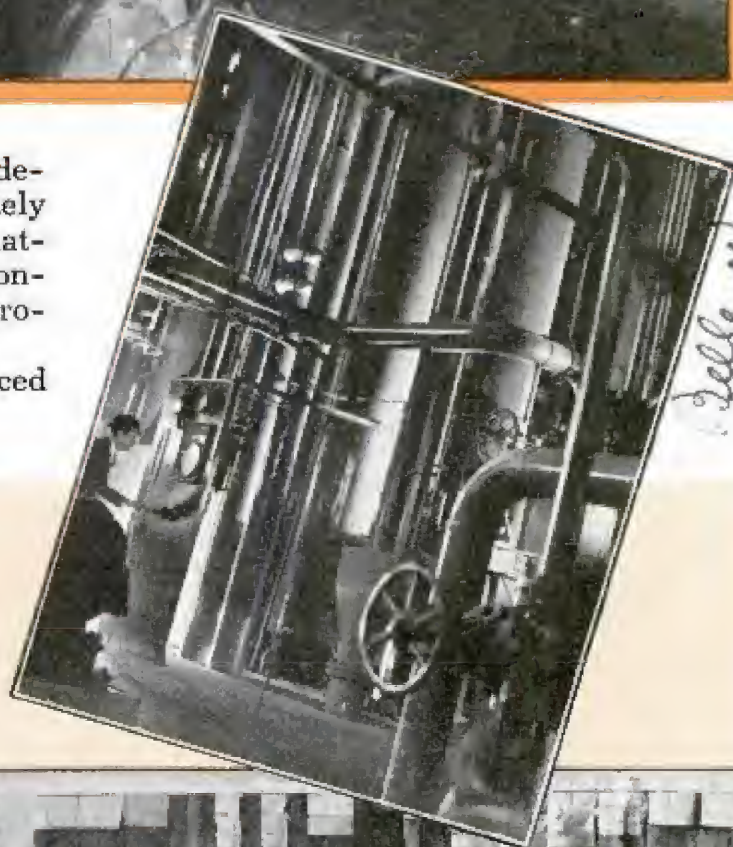
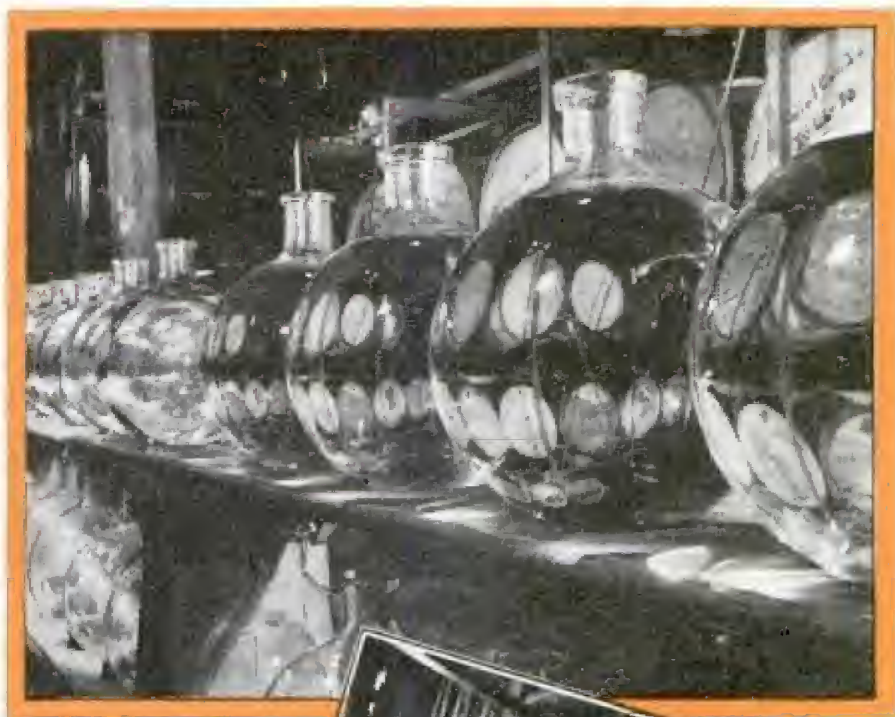
HELPS HIMSELF

portant American industrial and medicinal need is being filled, and, I am confident, will continue to be filled by American factories on American soil, whatever the emergency stemming from conditions in Europe or elsewhere in the world. This is due in no small degree to the accomplishments of American chemistry achieved during the brief span of two decades.

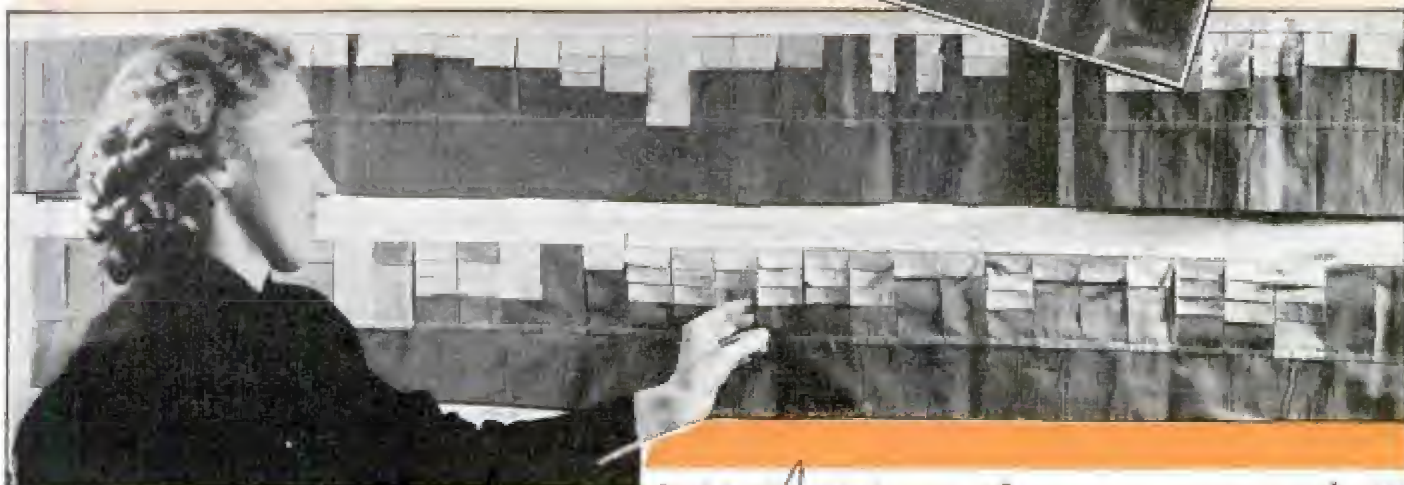
"This country did not have a single plant in 1914 to extract nitrogen from the air and transform it into the nitrates and other chemicals so vital to agriculture, industry and national defense. Then we were almost completely dependent upon the importation of natural nitrates from Chile. Today, in contrast, America is self-sufficient in nitrogen through chemistry.

"Similarly, the United States produced

(Continued to page 153A)

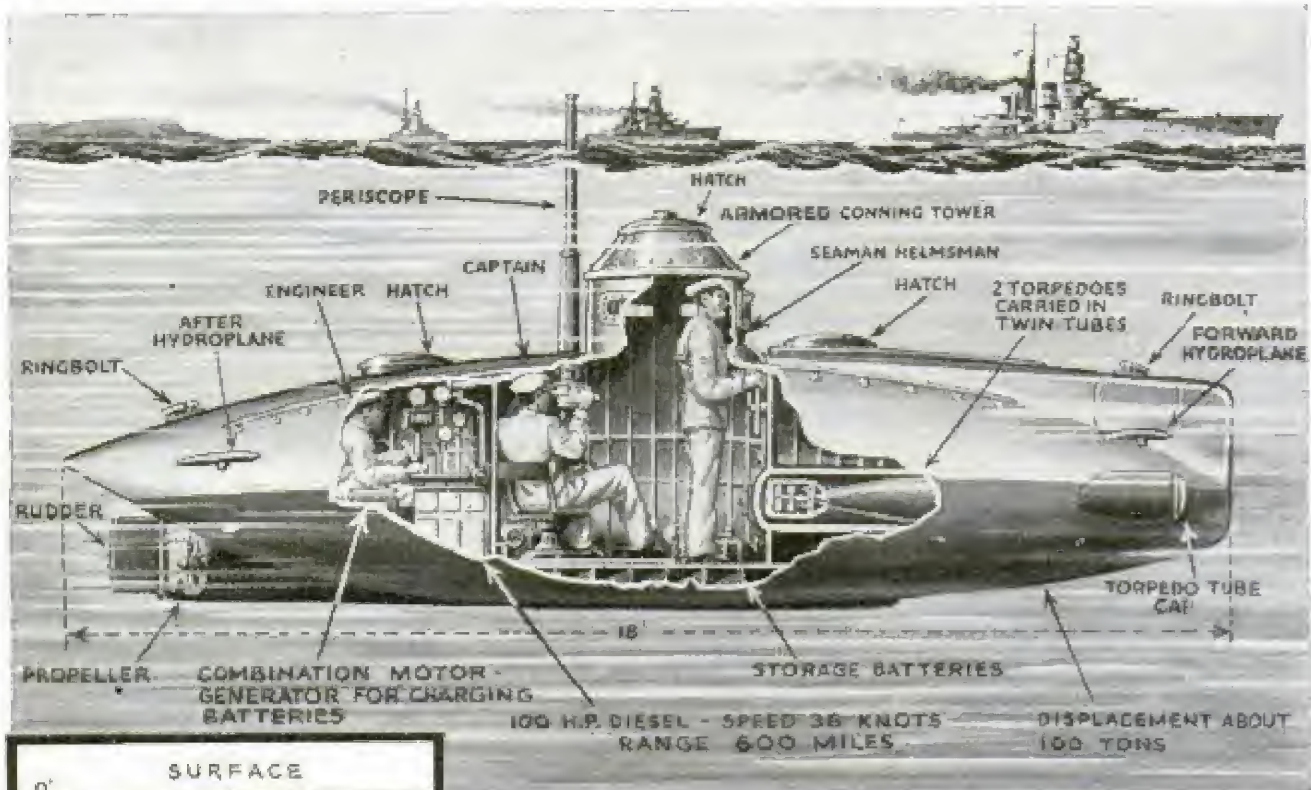


Top, bottles of terpeneol, chief constituent of synthetic lilac perfume. Center, equipment used in process by which carbon monoxide reacts with steam to produce carbon dioxide and hydrogen, the latter a component of ammonia and alcohol. Bottom, two dye strips, the upper a fastness test record of vat dye, lower, a direct dye

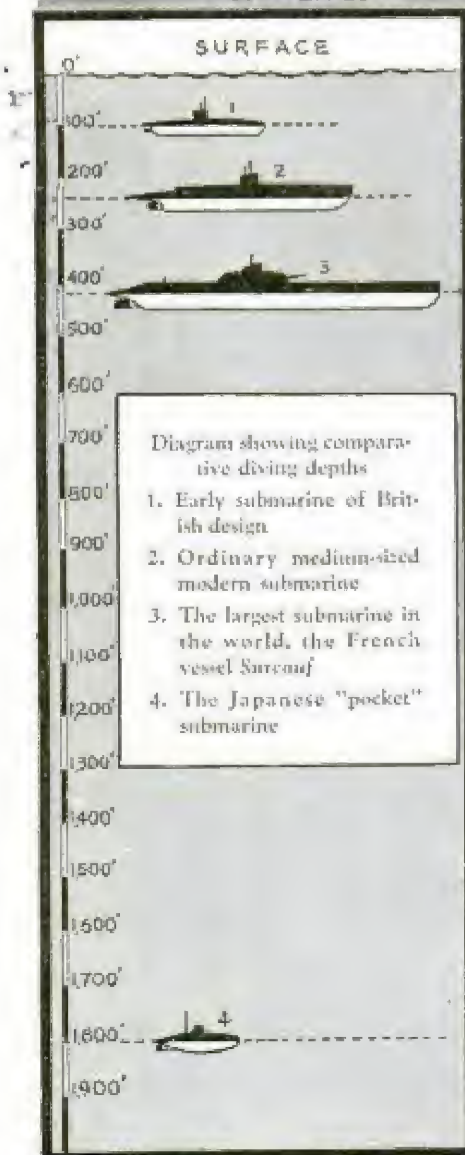


Technical Laboratory Deepwater
 175

Three-Man Submarine Makes 1,800-Foot Dive



Submarine "mosquitoes" with a powerful sting are reported under construction by Japan. Above is a cut-away view; left, a comparison of size and diving ability with other submarines



From Germany came the "pocket" battleship, from Japan comes the "pocket" submarine. A fleet of baby submarines that carry a three-man crew and can dive to the amazing depth of 1,800 feet is reported in production in Japan. Only eighteen feet from bow to stern, they are minnows compared with the French navy's 361-foot "Surcouf," world's largest submersible ship. While the conventional submarine may cost from two to four million dollars, Japan's deep-diving babies are understood to cost no more than a high-priced automobile, around \$5,000. They have a displacement of 100 tons, operating on storage batteries submerged, and driven by a 100-horsepower Diesel engine on the surface, with a top speed of around thirty-six knots and a 600-mile cruising range. A dive of 1,800 feet, where the pressure per square inch would be around 800 pounds, is unprecedented in naval annals. The ordinary modern submarine has a bottom of about 300 feet, and the French "Surcouf" is understood to be capable of plunging 400 feet. The pocket submarine carries two torpedoes. Its captain is stationed amidship at the periscope, the engineer sits aft and the helmsman stands forward at his wheel, watching through narrow window slots beneath the armored conning tower.

ⓈDull orange-colored highways built experimentally in the Channel Islands reduced road glare about forty per cent and cut down the accident rate.

Compressed Air Nov. 1939

J. & W. Co. Chas. & Thomas, Jr.
19618 Malibu Road
Pacific Palisades
Calif

WINNING RACES *in the* PITS



Testing tire and wheel (circle) results in balanced running gear. Below, hood of rear en-



Officials keep an eye on the race (top). These are members of the contest board. Left, Rex Mays at the wheel of a speedster entered in recent race. Note instrument panel



FAR down the stretch the race driver lifts his foot from the throttle and the car's exhaust stacks flame and sob as he goes into the turn and out of sight. Then there is a sharp staccato crash. It sounds like the car has hit the concrete retaining wall but it is only the noise of the exhaust as the driver tips the throttle momentarily for more speed.

In front of the grandstand a member of his pit crew rapidly compares gasoline capacity with the mileage run and raises a hand. "Pull him in for more fuel," he shouts above the constant roar of the other cars. One of the men chalks "Gas 2 Laps" on the black-

board. By now the car is entering the stretch again and the pit crew holds up the board. The driver acknowledges the message with upturned hand, then points back at the right rear tire. He'll want a tire change when he stops.

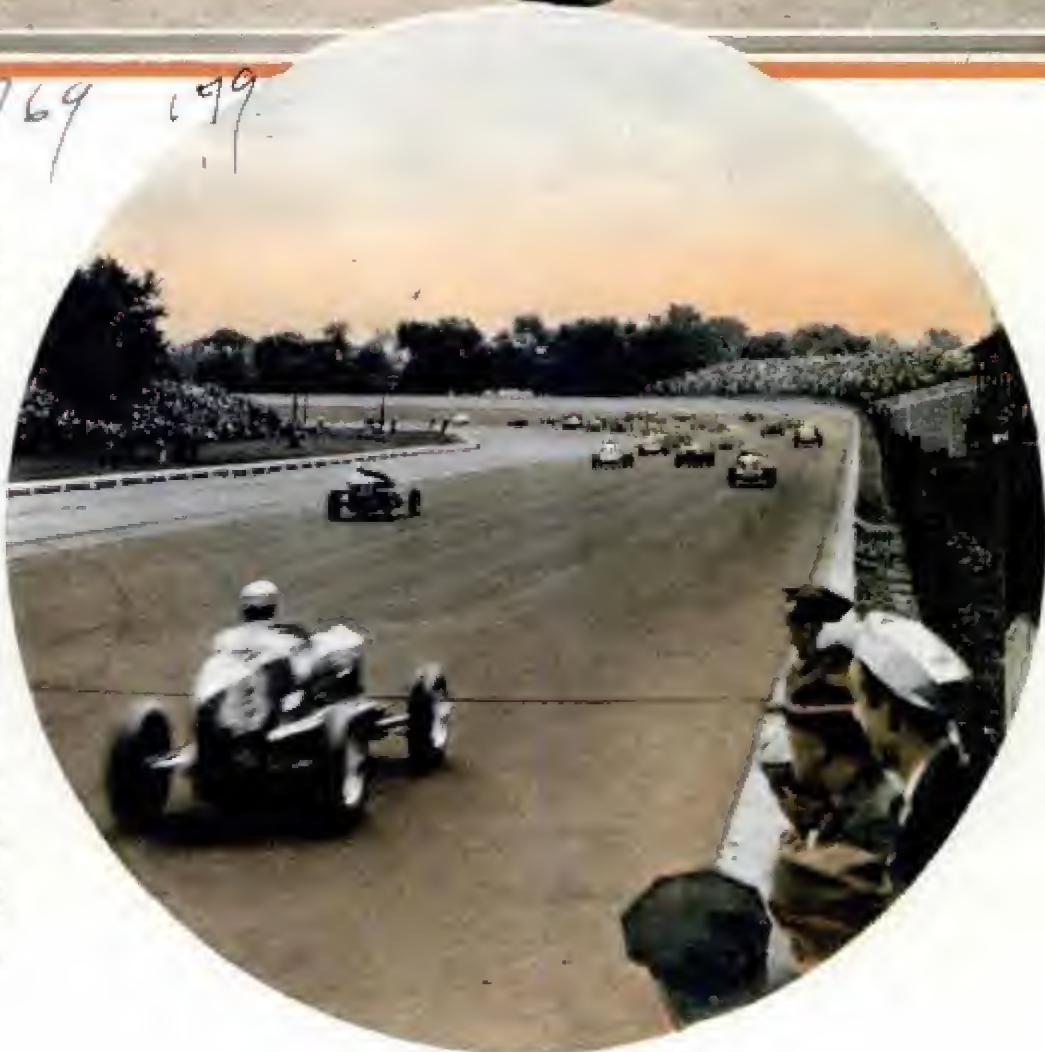
Two more laps and the driver slides toward the pit apron, still going seventy miles per hour as he approaches. The brakes stop him and three men dive over the pit wall, one with the fuel hose, one with the wheel jack, and the third with a new wheel and tire. The driver tears off his goggles, reaches for a bottle of water, and slumps back in his seat for a few seconds' rest. That's all he gets before the gas tank is full, the new tire mounted, the dirt and pulverized rubber scrubbed from the windshield, and a clean pair of goggles has been passed to him. Then he is under way again.

Public Relations Dept.
Indianapolis Motor Speedway
444 N. Capitol Ave. Indianapolis, Ind.
969



2769 199
Starting the mighty racing engines is usually accomplished with the aid of some outside power plant, such as the cart containing air supply and air motor which pit crew is shown wheeling up to the starting line (above) beside the car

Hurting down the stretch the speedsters flash by the spectators and head into the south turn in a group (right), thrilling the thousands upon thousands of racing fans who gather each Memorial Day for the annual renewal of the Indianapolis Speedway classic





96 79
 180
 Unsung heroes are these members of the pit crews, shown at work during the big race. Note blackboard with figures notifying driver that his last lap was run at 118 miles per hour. The pit crews keep a careful check on their entry in order to warn driver when he should come in for fuel or tires

Robert

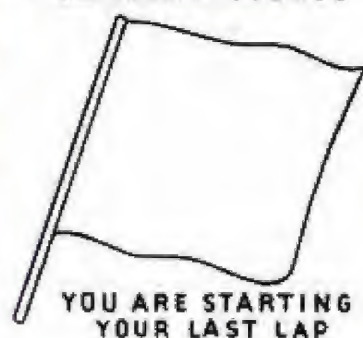


181 2679
 Checking the motor of the Indianapolis racing cars never seems to be finished. Above, Harry Miller and George Bailey make a final inspection. Right, flags used by track officials to control all movement of the cars, from the starting signal shown at top to the checkered finish flag at the bottom

Box 2038 Pittsburgh Pa
 A few feet down the line another car draws hastily up to its pit and the crew swarms around it. The driver hops out, his right foot dripping with black oil, and he wipes it from his clothes with a handful of waste while one mechanic sops up the pool in the cockpit and another tightens a connection on the oil line. From in front of another pit a car that stopped ten minutes ago and that won't start again is being pushed back to its garage.

We are in the pits of the Indianapolis speedway on Memorial Day and right now the annual 500-mile race classic is half over. Eight of the thirty-three cars that lined up at the start are out of the race already. One \$20,000 creation that stood a good chance of winning has lost out because of a faulty valve lock that cost no more than a dime. Another car that was a likely winner is in the pits permanently because the mechanics, in making a final inspection the night before, somehow got the drive shaft an eighth of an inch out of line. Al Miller and Russell Snowberger are stopped with broken radiators and Shorty Cantlon has a broken oil line.

Before the race is over every car will have made at least one pit stop and most of them will have been in the pits three or four times for motor adjustments and tires. The leaders are averaging 120 miles per hour, a pace that is bound to leave a trail of





*Waldie Stein
Firestone & Co.*

mechanical trouble. The winner this year could finish the race, drive to the next state and have lunch and return to the track in time to watch the finish of the race held in 1911, so much faster is he going.

During most of the race the mechanics have little to do except enjoy the spectacle, keep track of their driver's position and watch him for messages as he drones by. If he points to his mouth he may mean that his engine is running hot; pointing at his chest is the signal that he wants a relief driver. Holding up three fingers tells the pit crew that at least one cylinder is cutting out, and pointing to a tire warns the crew that he is preparing to stop for a tire change. Seven men are allowed in

Tires must be checked for the driver's safety as well as to insure proper inflation for high speed (top). Fuel technician compounding racing fuel from gasoline, tetraethyl of lead and other ingredients (circle)



2679



each pit and each is trained for his special job when the car pulls in. Four men are allowed on the track and the other three stay in the pit to pass the needed supplies. The materials in each pit include five extra tires and wheels, five sets of spark plugs, complete sets of tools and socket wrenches, extra goggles and a helmet, four fire extinguishers, fifteen pounds of rags, a blackboard and three pounds of chalk, a quick-action wheel jack and maul, and extra magnetos and other engine parts as well as gasoline, motor oil, and water.

No two fuels in the thirty-three pits are alike. Harry Miller, dean of American race-car builders, uses stock premium gasoline such as can be bought at any service station, but most of the other entries are powered with special high-test fuels ranging from secret mixtures to leaded gasolines having octane ratings as high as 130.

In the pits the odor of scorched rubber that has been torn off the tires by the track is strong and a driver rarely finishes without at least replacing his right rear tire. Each tire and wheel is balanced dynamically as a unit before the race



Zero hour for the big event finally arrives (top) and the pit mechanics push the cars to the starting line. Below, member of pit crew bending over chart on the pit wall. Speed of each car is clocked with stop watches and the time recorded, thus enabling each crew to have complete data on performance under varying conditions



Efficiency of pit crew is demonstrated as car makes a stop (top). Tony Gulotta gets the checkered flag (below) marking completion of his qualifying run in recent contest

2699
and the tubes are filled with nitrogen, this gas being non-explosive and less expansive than air.

For the mechanics the battle for speed really begins when the cars are first wheeled out for test laps, as much as a month before race day. Each pit crew has the job of finding the exact combination of adjustments and clearances that will develop the greatest power in their engine. Wise as they are, it still may take trial after trial before they

184
find the best combination. One crew tried everything their minds could think of to get their motor to turn up faster than 5,200 revolutions per minute. Finally they started experimenting with the fuel. Just a slight change in the proportions of alcohol, benzol, and leaded gasoline that they were using did the trick and on the next test lap the driver reported that the engine turned as high as 7,200 revolutions per minute.

(Continued on page 128-A)



'Ski-Cycle' and 'Ice Bike' Offer Winter Thrills



Left, "ice bike" pedaled at fast clip over ice provides something new in winter sport thrills. Below is another bikelike vehicle using skis instead of wheels which may be steered to avoid obstacles on snow-covered hills

Two adaptations of the ski and bicycle are offering speed and thrills to winter sport fans in Europe. One, called the "ski-cycle," consists of a frame mounted on three ski runners, upon which the rider sits as he would on a bicycle. The other is an "ice bike," having a runner in front and a wheel at the rear which is driven by pedals.



Side-Vision Tester Is Latest Aid in the War on Accidents



Perimeter shows patient how far to side she can see moving object while eye is focused directly ahead

Your eyes, if they are normal, should be able to detect a moving object at an angle of ninety degrees while looking directly ahead, since the outer regions of the retina are extremely sensitive to motion. For measuring accurately the extent of side vision, a perimeter has been developed by American Optical company. The subject, with one eye masked, looks steadily at a point in the middle of the instrument. Then colored objects are moved along the inside of the semi-circular frame which is divided into 180 degrees, and the points at which they can be distinguished indicate the boundaries of his field of vision for the different colors. For normal persons the field is widest for white, then follow blue, red and green in that order. Anyone who fails in the test is advised to visit his doctor because faulty side vision frequently is a cause of traffic accidents.

■A German newspaper recently printed an edition on paper made from potato leaves and stems, developed experimentally in a search for wood-pulp substitutes.

American Optical Co.
Southbridge, Mass

no data

Rails Laid in Sections to Speed Track Building



Complete track section, consisting of rails and ties pre-assembled at factory, being placed on prepared roadbed by mobile crane in Russia where railroads are laid in feverish haste

Laying standard length sections of pre-fabricated track, which are carried to the roadbed on flatcars, is one of the methods used in hastening the building of railroads in the Soviet union. Rails can be spiked to the ties faster in shops than on the road, and handling of much material is elimi-

nated. A powerful crane of the track-laying machine picks up a section and swings it out in front of the car where it is guided into place on the prepared roadbed. After the crew has made it fast to the preceding section, the track layer advances upon the new track to put down the next section.

Sun's Heat for Warming Home in Winter Stored in Tank

Heat and energy from the sun, trapped in the roof and stored in a basement tank for

future use, will warm an experimental house constructed at Massachusetts Institute of Technology for

studying various uses of solar heat, including winter house heating, summer air conditioning and power generation. In a recess on the roof is a shallow, boxlike "heat trap," the bottom of which consists of a thin sheet of metal painted black to absorb the utmost amount of solar energy. Under this is a series of thin-walled metal tubes, which heat water circulating through them by their contact with the sheet. Several panes of glass



Heat trap under glass roof causes sun's rays to heat water which is then stored in basement tank for use in warming home during cold weather

covering the box let in the sunlight, but prevent heat from escaping, while mineral wool under the tubes keeps heat from slipping out in that direction. The heated water passes through insulated pipes to a large storage tank so well insulated that it will keep water hot from a few weeks to half a year, depending upon the tank's size. To use this heat for warming the home, a system of forced circulation passes air through ducts that have one wall on the hot side of the tank. A small sunlight collector on the roof can be used for storing heat all summer in a tank large enough to hold an entire winter's supply of heat; or a collector large enough to heat the house directly might be used.

Alcohol Changes Iron to Steel in Glass-Tube "Furnace"

Under the influence of alcohol, iron changes to steel. Westinghouse engineers recently paraded on a screen the antics of a thin iron wire as it became hard steel when heated in an eighteen-inch glass tube filled with alcohol vapor. Electrodes entered the tube through plugs at either end, and hydrogen gas bubbled through methanol alcohol into the tube. As the wire heated, the reaction of the alcohol with the surface of the wire caused carbon to leave the alcohol and enter the wire, saturating it and hardening the wire as it cooled.



Image of iron wire tube is seen on screen as it changes to steel under influence of heat and alcohol

Boat Folds Up Like Trailer for Towing on Land



Forming its own trailer when towed on land, above, metal boat is unfolded when it reaches water

Hinged in the center so the stern folds upward to form a closed body, a fourteen-foot motorboat can be converted into a trailer within one minute. With airtight compartments fore and aft, and air space beneath the flooring, the 185-pound craft is non-sinkable and may be fitted with an outboard motor. A seal is created at sides and bottom of the two joining sections, by locking with levers the wedge-shaped edge of one section into a rubber-lined V-slot comprising the opposite edge. Two springs and a pair of levers make it possible to lower the boat while the trailer is backed into the water, and the operation is reversed to lift it out. The boat-trailer and its carriage weigh about 500 pounds.

Land. J. C. Smith, 3225-26th Ave.
Sacramento, Calif.

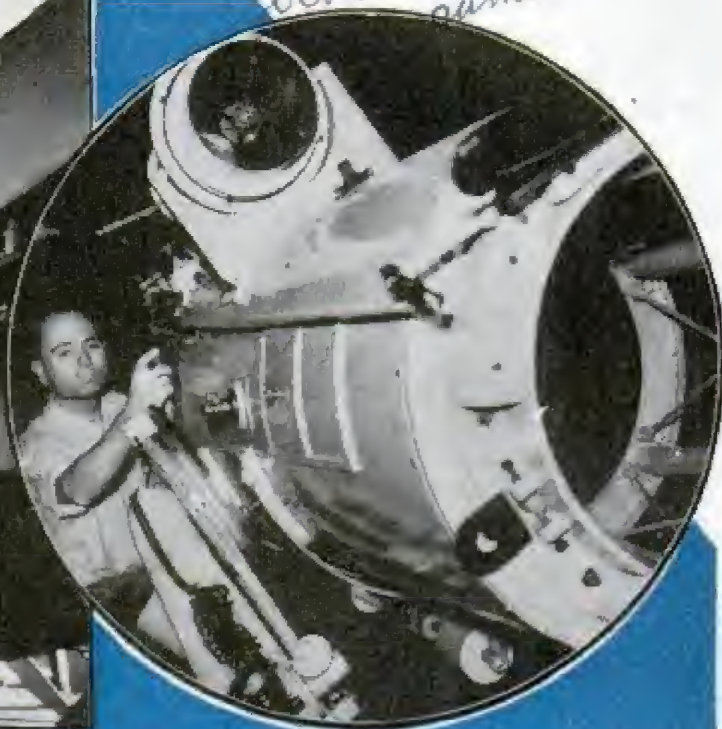
Research Metallurgy

Reference: Dr. John G. Watson, Astronomer, Palomar



Left, part of north horseshoe bearing of telescope. It weighs 156 tons. Circle, mapping areas to be explored with giant telescope. Below, small telescope with 200-inch dome in background

Schmidt camera



The BIG EYE

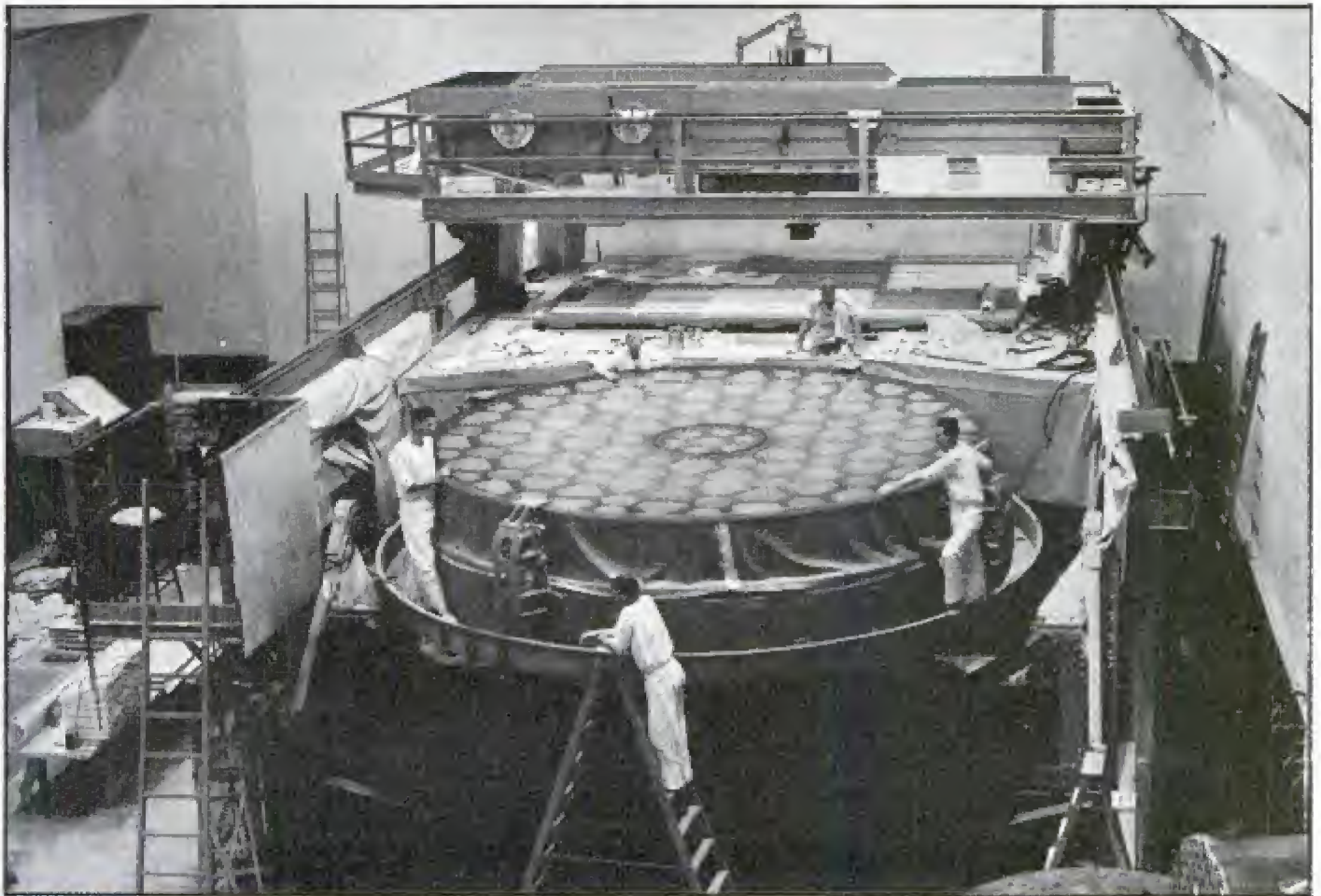
BUSY exploring distant corners of the universe, astronomers are taking time out to watch construction of their mightiest instrument, the 200-inch telescope being assembled by the California Institute of Technology on Palomar mountain in southern California. At first scheduled for completion this winter, the new observatory may not be in operation for another year and a half because of the time being taken to improve the original plans.

The huge fourteen-story-high dome has been finished, and work on the telescope is practically complete. Work still to be done consists mainly of the final polishing of the great mirror and completion and mounting of the other optical elements of the telescope.

Palomar's instrument has been called the world's greatest eye, a gigantic spy-glass that will bring unknown reaches of the universe within range of observation



Photo courtesy T. V. Waterson



TAKES SHAPE

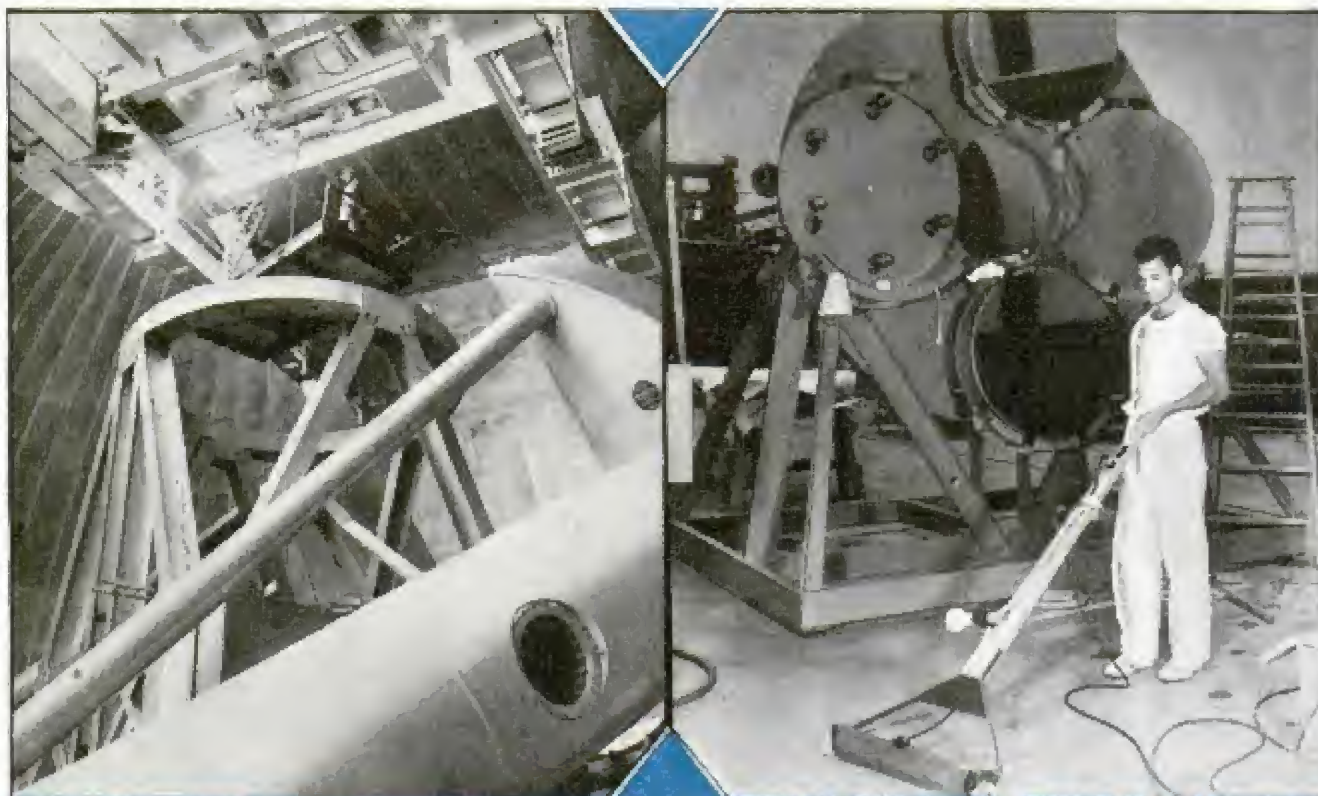


Top, 200-inch mirror on bed of grinding machine; white patches seen through clear glass are indentations in bottom which will rest on mirror supports. Bottom, steel yoke to support barrel of telescope; note size of workman in center foreground

and probably solve many of the problems that perplex scientists. It's more than that.

Its construction represents a sort of final examination for most of the physical sciences. If technical knowledge could be asked to tackle one involved problem just to show how capable it is, the construction of this telescope might be the one perfect question to ask it. The hundreds of problems attached to its construction have required the combined brains of the most able men of the world in their fields.

This telescope is so large that you need an elevator to reach its top. Astronomers working at different parts of the apparatus will com-



Left, workmen descend from dome to assemble framework of telescope barrel. Right, electromagnetic sweeper picking up metal dust that might scratch mirror; in background, mirrors used to figure optical curves of telescope mirrors. Bottom, attaching pitch facets to grinding tool

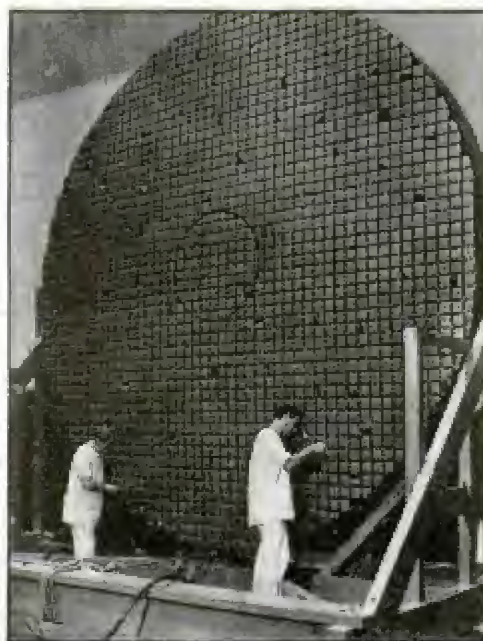
municate by telephone. Yet its adjustment has to be so precise that ordinary contraction and expansion might upset its alignment. The dome is doubly insulated with aluminum paint and an inner sheathing of aluminum metal to keep the night and day temperature range within five degrees.

Its moving parts weigh approximately one million pounds, yet the instrument is so delicately balanced that only one-half horsepower is needed to turn it. An ordinary steel structure the size of the telescope would deflect appreciably because of its own weight, yet this instrument is so inflexible that its barrel bends less than eight-hundredths of an inch along its length. Even that amount has to be compensated for.

Glass is one of the most inflexible materials known, yet in some positions the big mirror, more than sixteen feet across, would normally bend one or two ten-thousandths of an inch

from its own weight. A microscope would be needed to measure this deflection but it would be enough to make the mirror worthless. The astronomers have had to arrange an intricate support system to keep the mirror perfectly rigid. Instead of resting flat on its steel bed it is to be attached to its bed by thirty-six supports that consist of lever and counterbalance arrangements.

The light from dim stars is so weak that photographic film must be exposed for hours before satisfactory records are obtained. Make an all-night exposure of the heavens with your own camera and you get star trails that extend from horizon to horizon. The goal of astronomers in photographing a star is to record no more than its tiny pin point of light, and to do this they must keep their telescope pointed unwaveringly at the star all through the exposure. The telescope must turn as slowly and



steadily as the earth itself to compensate for the earth's rotation. Its accuracy has to compare with keeping a rifle aimed exactly at a twenty-five cent piece rolling along the ground three miles away. To provide this steadiness the telescope is being floated on a film of oil. It is to be driven by giant gears cut to the precision of those of a fine watch.

Even these precautions are not enough to hold the image of a star stationary on a photographic film. Atmospheric refraction alters the apparent position of a star and the influence of refraction changes as the star's position above the horizon changes. Variations in the weather also influence refraction.

The result is that in today's large telescopes a star appears to jiggle and sway slowly when examined through the sighting eyepiece. While making an exposure the astronomer has to keep guiding his film holder up and down or sideways to minimize these motions. No human is capable of doing the job perfectly, so at Palomar the work is being turned over to complicated sets of electrical brains that will automatically compensate for every variable and will guide the telescope on a course that holds the star still.

Because weather affects the refraction of a star, a complete weather reporting station has been built adjacent to the observatory. At the telescope an attendant turns a group of pointers to the temperature, barometer, humidity and other settings that correspond to the weather conditions and then presses a button that operates the weather computing machine. This device then automatically modifies the speed of the telescope's driving motors to compensate for the exact refractive influence of atmospheric conditions.

At the same time that the telescope slowly turns on its bearings to follow a star across the sky the great steel dome under which the telescope is housed, weighing 1,000 tons, likewise turns to permit continuous observation through its shutter opening.

The public will be able to inspect the great telescope at almost any time from a special glass-enclosed visitors' gallery that has been completed inside the dome. The workings of the complex instrument will

(Continued to page 150A)

Gas Mask Has Loud Speaker to Amplify Muffled Voice



Speaker and microphone combined with gas mask enables soldier to be heard without removing guard

Gas masks are being equipped with microphones and loud speakers to make it possible for soldiers to give orders and to be heard in ordinary conversation. In many instances the wearing of masks prevents the men from communicating with one another except by signs.

Three-Wheel Streamline Skate Has Brake at Heel



By mounting three wheels in line, new enjoyment and possibly more speed have been added to the sport of skating. Brakes are applied by lifting the front part of the skate.

Biscuits Are Baked Quickly in Top-of-Table Oven



Hot biscuits are freshly baked eight at a time right on your table with this diminutive electric oven

It requires only seven minutes to produce a batch of biscuits with an electric baker that may be set on the table. The oven takes no more space than the average size waffle iron, yet it will bake eight large biscuits at one time.

Mower with Rotating Disks Cuts All Field Growths

All types of field growth, except trees more than an inch in diameter, can be cut with a mowing machine that uses three

rotating disks. These disks are mounted beneath the machine, and their edges are studded with replaceable triangular cutters that revolve at 4,000 feet per minute when the mowing speed is twenty miles an hour. At this speed fifteen acres can be cut over in an hour. The standard machine cuts a swath seven feet wide, and it is adjustable to shear down to within one-quarter inch for golf courses or to leave a stubble up to eight inches high. It is said to handle anything from palmetto scrub and small bushes to the finest hay or grass, traveling at speeds from one mile per hour in soft soil or thick scrubland to thirty-two miles on level ground. A side delivery rake may be attached for mowing hay, clover or alfalfa.

Dash-board Light Gives Warning When Battery Needs Water

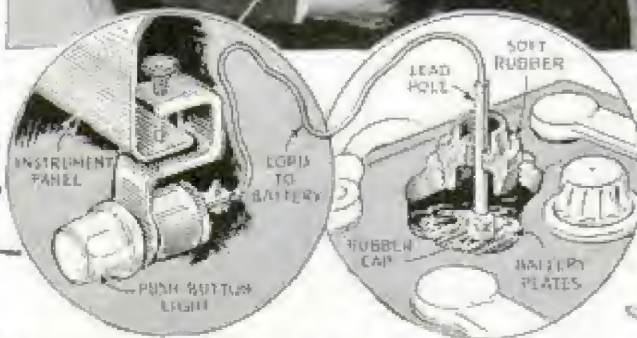


Diagram shows how lead pole is installed in battery to signal water level as dash button is pressed

Motorists can make a frequent check of the water level in the automobile battery with a dashboard connection that tells instantly with a light signal whether water should be added. A rubber cap and lead pole are installed in place of one of the battery plugs, and so long as water touches the pole a circuit to the dashboard light is made. If water falls low enough to endanger the battery, the circuit is broken and the light will not glow when the dash button is pressed.



One of the rotating disks may be seen beneath truck

*Dischop Machine Shop
Acadia
Louisiana*

*old chassis
8-96 hp.
whalbar*

*Chicago
2909
Indiana*

*Sale Unit
7.10.11.12.13.14.15.16.17.18.19.20.21.22.23.24.25.26.27.28.29.30.31.32.33.34.35.36.37.38.39.40.41.42.43.44.45.46.47.48.49.50.51.52.53.54.55.56.57.58.59.60.61.62.63.64.65.66.67.68.69.70.71.72.73.74.75.76.77.78.79.80.81.82.83.84.85.86.87.88.89.90.91.92.93.94.95.96.97.98.99.100.101.102.103.104.105.106.107.108.109.110.111.112.113.114.115.116.117.118.119.120.121.122.123.124.125.126.127.128.129.130.131.132.133.134.135.136.137.138.139.140.141.142.143.144.145.146.147.148.149.150.151.152.153.154.155.156.157.158.159.160.161.162.163.164.165.166.167.168.169.170.171.172.173.174.175.176.177.178.179.180.181.182.183.184.185.186.187.188.189.190.191.192.193.194.195.196.197.198.199.200.201.202.203.204.205.206.207.208.209.210.211.212.213.214.215.216.217.218.219.220.221.222.223.224.225.226.227.228.229.230.231.232.233.234.235.236.237.238.239.240.241.242.243.244.245.246.247.248.249.250.251.252.253.254.255.256.257.258.259.260.261.262.263.264.265.266.267.268.269.270.271.272.273.274.275.276.277.278.279.280.281.282.283.284.285.286.287.288.289.290.291.292.293.294.295.296.297.298.299.300.301.302.303.304.305.306.307.308.309.310.311.312.313.314.315.316.317.318.319.320.321.322.323.324.325.326.327.328.329.330.331.332.333.334.335.336.337.338.339.340.341.342.343.344.345.346.347.348.349.350.351.352.353.354.355.356.357.358.359.360.361.362.363.364.365.366.367.368.369.370.371.372.373.374.375.376.377.378.379.380.381.382.383.384.385.386.387.388.389.390.391.392.393.394.395.396.397.398.399.400.401.402.403.404.405.406.407.408.409.410.411.412.413.414.415.416.417.418.419.420.421.422.423.424.425.426.427.428.429.430.431.432.433.434.435.436.437.438.439.440.441.442.443.444.445.446.447.448.449.450.451.452.453.454.455.456.457.458.459.460.461.462.463.464.465.466.467.468.469.470.471.472.473.474.475.476.477.478.479.480.481.482.483.484.485.486.487.488.489.490.491.492.493.494.495.496.497.498.499.500.501.502.503.504.505.506.507.508.509.510.511.512.513.514.515.516.517.518.519.520.521.522.523.524.525.526.527.528.529.530.531.532.533.534.535.536.537.538.539.540.541.542.543.544.545.546.547.548.549.550.551.552.553.554.555.556.557.558.559.560.561.562.563.564.565.566.567.568.569.570.571.572.573.574.575.576.577.578.579.580.581.582.583.584.585.586.587.588.589.590.591.592.593.594.595.596.597.598.599.600.601.602.603.604.605.606.607.608.609.610.611.612.613.614.615.616.617.618.619.620.621.622.623.624.625.626.627.628.629.630.631.632.633.634.635.636.637.638.639.640.641.642.643.644.645.646.647.648.649.650.651.652.653.654.655.656.657.658.659.660.661.662.663.664.665.666.667.668.669.670.671.672.673.674.675.676.677.678.679.680.681.682.683.684.685.686.687.688.689.690.691.692.693.694.695.696.697.698.699.700.701.702.703.704.705.706.707.708.709.710.711.712.713.714.715.716.717.718.719.720.721.722.723.724.725.726.727.728.729.730.731.732.733.734.735.736.737.738.739.740.741.742.743.744.745.746.747.748.749.750.751.752.753.754.755.756.757.758.759.760.761.762.763.764.765.766.767.768.769.770.771.772.773.774.775.776.777.778.779.780.781.782.783.784.785.786.787.788.789.790.791.792.793.794.795.796.797.798.799.800.801.802.803.804.805.806.807.808.809.810.811.812.813.814.815.816.817.818.819.820.821.822.823.824.825.826.827.828.829.830.831.832.833.834.835.836.837.838.839.840.841.842.843.844.845.846.847.848.849.850.851.852.853.854.855.856.857.858.859.860.861.862.863.864.865.866.867.868.869.870.871.872.873.874.875.876.877.878.879.880.881.882.883.884.885.886.887.888.889.890.891.892.893.894.895.896.897.898.899.900.901.902.903.904.905.906.907.908.909.910.911.912.913.914.915.916.917.918.919.920.921.922.923.924.925.926.927.928.929.930.931.932.933.934.935.936.937.938.939.940.941.942.943.944.945.946.947.948.949.950.951.952.953.954.955.956.957.958.959.960.961.962.963.964.965.966.967.968.969.970.971.972.973.974.975.976.977.978.979.980.981.982.983.984.985.986.987.988.989.990.991.992.993.994.995.996.997.998.999.1000.*

Forest-Fire Fighters Parachute into Treetops



At left, forest ranger shows how he "bails out" with parachute that can be steered, descending slower than fourteen feet per second. Canvas and sponge-rubber suit and helmet protecting face permit him to land in rough country. Below, parachute comes down in forest and flying fireman lands in tree.



Flying firemen who drop right into the treetops with specially designed parachutes are to guard western timberlands against the fire menace. Too frequently a small fire breaks out far from road or trail and spreads into a conflagration covering thousands of acres before the Forest Service rangers can reach it. But with airplanes carrying fire fighters and equipment right to the blaze, it can be quelled before it is too big to control. Experiments are being conducted in the Chelan National Forest near Wenatchee, Wash. The fireman goes aloft wearing a canvas and sponge-rubber suit, a "cage" helmet and neck protector, ankle supports and other guards to protect vital parts of the body in the parachute jump over rocky or wooded terrain. Selecting a strategic spot, he first dumps overboard a kit containing shovel, ax, flashlight, matches, two

days' emergency rations and water, map, compass, first-aid kit and perhaps a radio set. The ranger's parachute permits steering and a descent at fourteen feet per second or slower. With his protective garb he can come down safely in a dense forest, using an emergency rope in his coat pocket for descending from treetops if he is snagged in a dangerous spot.

Forest Fire Chief.

Agiculture
Washington, D.C.
Frank Henry
Los Angeles
parachute drops

Methow Valley
near Wenatchee
Wash

Club.

SUPER-



Mr. Martine, Research Lab.
By Roderick M. Grant

YOU'RE missing a lot in this world. There are sounds you can't hear, colors too delicate and scenes too swift for the eye to catch, tastes and odors and sensations of touch that are far beyond the range of puny human senses.

The eye of man has been called the most perfect optical instrument, yet in a spectrum stretching over ten quintillion angstrom units—that's ten followed by eighteen ciphers—your eye discerns light from a paltry 4,000-unit span in the middle of the spectrum. You boast of hearing a pin drop in a great auditorium, or the ticking of a watch across the room; yet your ears are tuned only to sounds vibrating from thirty to 16,000 cycles per second, while

At upper left, human eyes behind electric eyes; the photoelectric tubes can perform feats beyond the ability of man's eyes. Top, center, telephone worker "feels" distance to break in line with aid of Wheatstone bridge. Right, microphone picks up tick of watch in General Electric's soundproof room. Below, research worker listens to sound from invisible film

Schenectady, N.Y.

Developed by J. H. Williams
General Electric Co. 21212

Chula
mine safety apparatus
2.10.10 n. B. radcliff

SENSES of SCIENCE



Surface indicator at top measures smoothness of metal or painted surface. Below, miner wearing gas mask and helmet carries a carbon-monoxide detector



science has measured and put to work inaudible sound as high as 5,000,000 cycles.

You feel and see and taste and hear and smell with senses attuned to the Stone Age, when your ancestors had only to detect an

enemy in time to escape, and to hunt a meal. They had no need for fitting pistons within cylinders to tolerances measured in millionths of an inch, nor to listen for lurking submarines nor measure the light of distant stars which they never could hope to see.

But while your eyes and ears have lingered as they were 25,000 years ago, science has given you tools of a supersensitivity that staggers human imagination. A camera with multiple eyes and no lenses takes 120,000 pictures per second. Invisible light and inaudible sound are put to work killing bacteria. The odorless, unseen mist rising from a bowl of mercury in so rare a concentration as one part of mercury in 5,000,000 parts of air is made visible to the human eye as a thin shadow cast on a fluorescent screen—yet this mercury could go on evaporating for ten years without a detectable loss in weight.

There is a practical side to these vapor and gas detectors, of course. A miner car-

Developed by R. C. Price
and H. Rankin

Engineering Dept. - Es 8
Chula - Wally



will expose counterfeit currency or postage stamps. A manufacturer of paper or textiles or other goods can examine his competitor's product under the spectrophotometer and learn whether inferior materials have been used. It is even a shortcut in chemical analysis, for a slight variation in solutions alters the color reflected into the measuring instrument. A millionth of a gram of copper in solution shows up as a characteristic curve on the color graph. When a medical laboratory wanted to publish a table of human-

ries in one hand a little meter that warns instantly of the presence of deadly carbon-monoxide gas he can neither see nor smell. These detectors are constantly analyzing the air in New York's vehicular tunnels. Mercury-vapor detectors in the exhaust stacks of mercury turbine power plants tell of escaping vapor, and the plant is shut down immediately to avert loss. In the mercury-vapor turbines of the General Electric company at Schenectady, for example, there are 100,000 pounds of mercury worth \$2.20 a pound, and any evaporation up the chimney would be expensive.

One of the newest scientific substitutes for imperfect human senses is General Electric's spectrophotometer, whose photoelectric "eyes" translate colors into curves. Pull out of your dresser drawer a pair of stockings that look like identical twins, put them to the spectrophotometer test and in five minutes it will draw two spectral graphs that prove those stockings don't match at all. So sensitive that its motor could be started and reversed by the light of a candle a mile away, this color meter and recorder has already found its way into a dozen industries. It is standardizing dyes, matching colors in the textile, paper and paint industries. A spectrophotometer test of canned food shows whether coloring matter has been added and whether the adulterant was poisonous. A color line varying slightly from normal

blood samples so that doctors, comparing the blood of patients with the printed scale, could discover symptoms of anemia, the printers had to find red inks that would match each blood sample perfectly. They achieved perfection by mixing the inks until graphs of blood and graphs of ink samples were identical.

Delicate finger tips of the blind are so sensitive that they learn to read swiftly the raised Braille letters. But an engineer

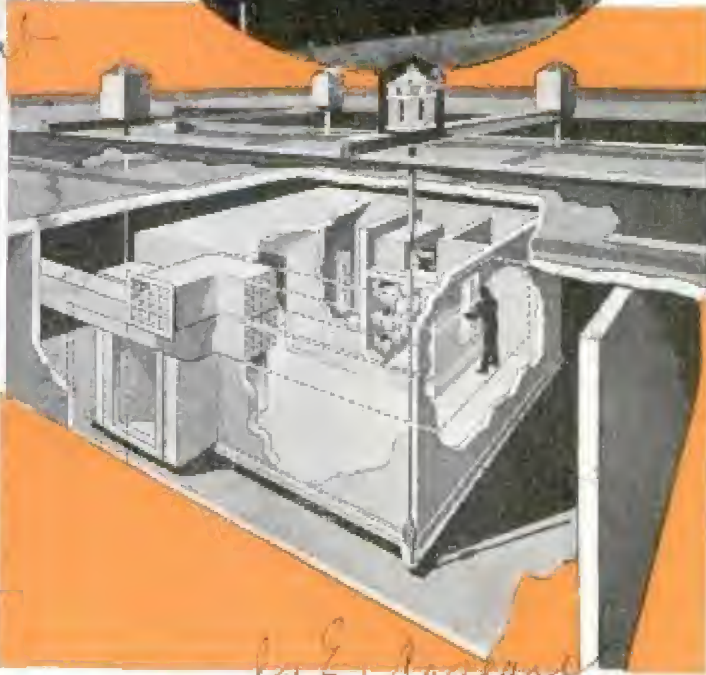


Mercury-vapor detector, top, sounds alarm bell when costly and dangerous vapor escapes in mercury power plant. At bottom, preparing orifice in wall for sound test of fan in General Electric's aphonic room

Research Lab. Is E

has developed a "roughness meter" that can measure the thickness of a finger print on a pane of glass. Somewhat resembling a phonograph with a sapphire-pointed needle that "feels" the object being tested, it can sense variations as small as a millionth of an inch in the smoothness of metal bearings or painted surfaces. The "Wheatstone Bridge" gives the sense of touch a sort of third dimension, telling the telephone company's troubleshooter the exact distance to the point where—perhaps several miles away—a line has been grounded. You feel a bit uncomfortable if the room thermometer falls below sixty-five or rises above eighty degrees; an electric potentiometer, tool of the research scientist, detects temperature changes of a few thousandths of a degree. When you catch cold and lose your sense of taste you could munch bonbons and potatoes, while blindfolded, without distinguishing the difference. The chemist has

(Continued to page 120A)



At top, General Electric engineer measures hues of silk stockings with photoelectric eyes of recording spectrophotometer, an instrument that draws curves on graph distinguishing colors seeming identical to human eye. In circle, science's "taster," a Leeds & Northrup company electric indicator measuring acidity and alkalinity. Bottom, diagram of General Electric's soundproof test room showing suspension from rubber-cushioned springs on roof; left, red light replaces telephone bell in quiet room

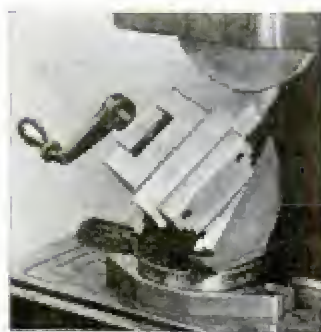
Tiny Lamps for Searchlight Are Cooled with Water



Powerful searchlight is shown above with one of the mercury-lamp units held by lighting specialist.

Light for a 25,000,000-candlepower searchlight developed by General Electric comes from three small water-cooled mercury lamps instead of the customary carbon arc. With no carbons to be replaced or adjusted, the new searchlight functions without attention. Although no larger than a cigarette, each high-pressure mercury lamp is rated at 1,000 watts. They are mounted close together, and seventy per cent of the heat they generate is removed by pumping ninety gallons of water an hour through cooling jackets. A time switch turns the lights on automatically according to a prearranged schedule.

Vise Holds Work at Any Angle for Machine Operations

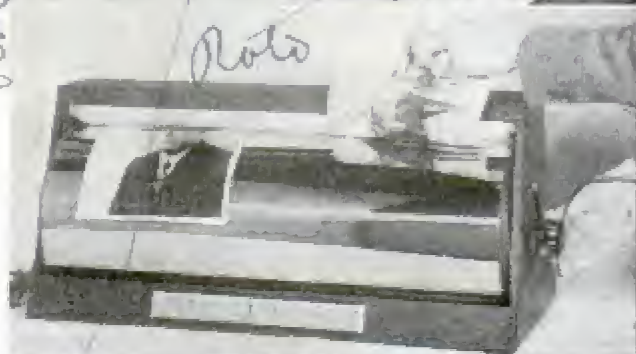


Complicated compound angles are easy to produce in milling, grinding and drilling operations with a universal vise that is adjustable in three planes. Graduated

scales in each plane give this all-steel vise a rapid adjustment and assure accuracy in handling heavy as well as light cuts.

Low-Cost Photo Print Dryers Furnish Fast Electric Heat

Electric print dryers, reasonably priced for the amateur or professional photographer, turn out smooth, dry pictures in quick time. One of the models recently introduced is a rotary dryer with chromium-plated drum, turned by hand. It dries prints in four to eight minutes, and is available in twenty-eight by twenty-four-inch and twelve by eighteen-inch drying surfaces. Another has an alloy platen area twelve and one-fourth by sixteen and one-fourth inches, a curved platen with a heavy duck apron to cover the prints. Thermostatic controls keep the dryers from overheating.

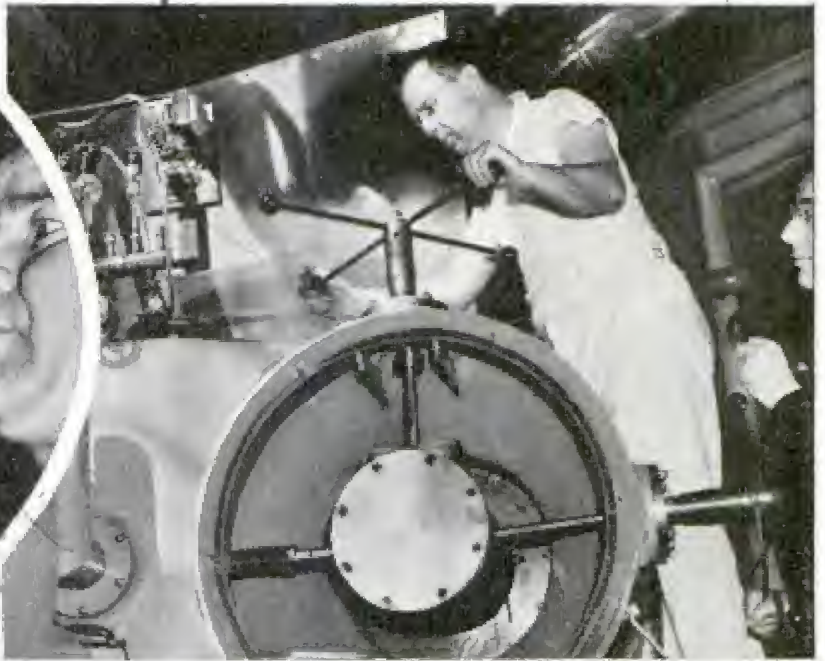


Electric print dryer with curved platen and duck cover, above, and rotary dryer turned by hand

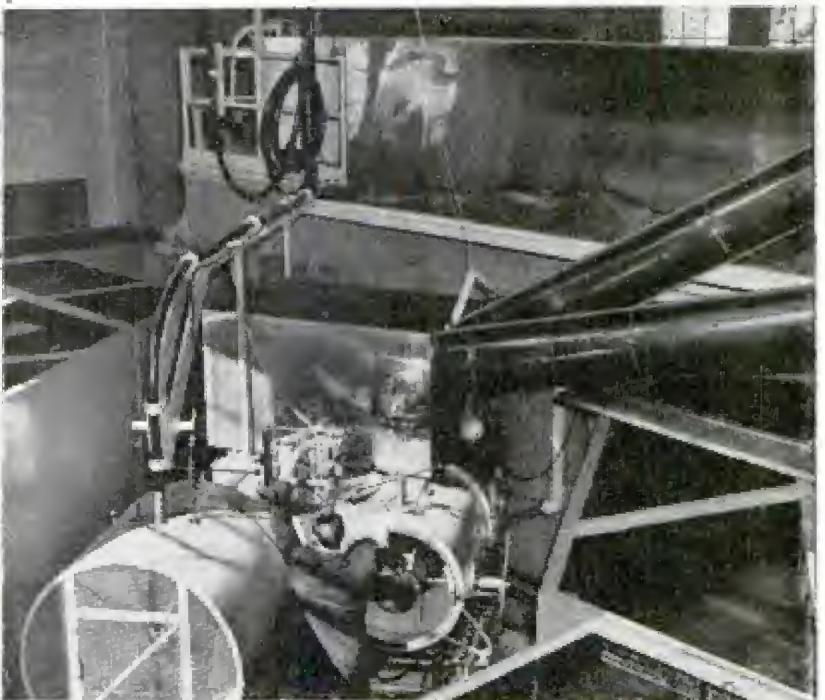
Wesson Co 1050 Mt
Elkhart Ave. Elkhart

Arday Laboratories, Inc.
1570 81st St

220-Ton Atom-Smasher Latest Aid to Science



From the mysterious atom, scientists hope to wrest invaluable secrets, such as information that may enable them to release and control vast energy by smashing the atom. One of the latest aids in this research is a 220-ton cyclotron located in the William H. Crocker radiation laboratory of the University of California. Above, left, the point at which ions enter the huge machine before going into their spiral path at "dees" at accelerated speed. Right, adjusting dees for positioning the ion beam



Above, unusual view of the giant atom-smasher. Large vats of water surrounding the machine protect workers from radiation. Tubes above lead from the oscillator. At left, operating control board of the cyclotron. This control board is in another room, away from the machine, and communication with observers is conducted over a public-address system. The loud speaker for the system is shown at the right hand of the attendant. Data obtained with the machine are expected to aid the medical field, and possibly to reveal a new source of power. So great are the possibilities that no scientist cares to predict what the results may be

Robert Carnoy

C 10 5:4 James H. Dunning 98 45th Kansas City Mo

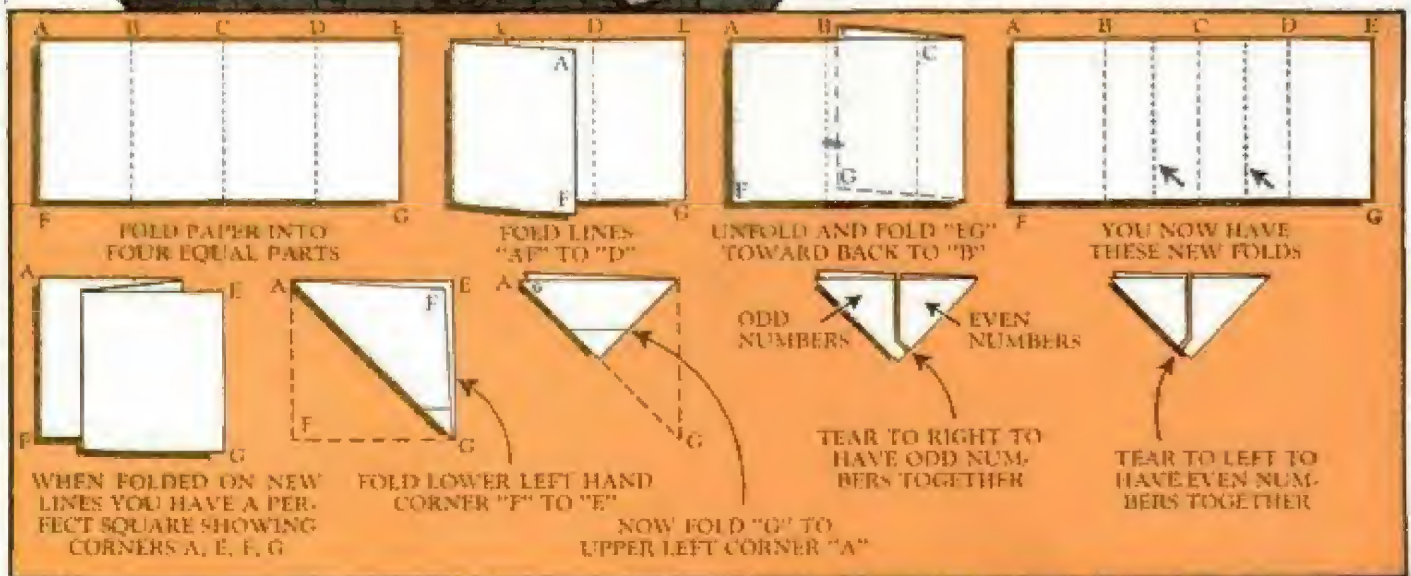
There's **MAGIC** in



the numbers 1, 2, 3, 4 have been inscribed from left to right and underneath them, from right to left, 5, 6, 7, 8. By a series of folds, the sheet is reduced to a triangle. The performer explains that he will, at a spectator's bidding, make a single tear in the triangle so that the odd or even numbers will be left on the paper.

Making a cornstalk

You need no satchel of "props" for this trick. Write the numbers on a slip of paper, fold as shown, and with a single tear down center of triangle, odd or even numbers are left together



THERE are styles in magic just as in clothes or motorcars and at the moment, simple, close-up stunts performed with everyday objects are enjoying a greater vogue than ever.

A person who yawns while a professional magician saws a woman in half will watch with open-mouthed astonishment as a friend executes a neat trick with paper matches, drinking glasses, or some other household object. The fact that the tricks are executed with such commonplace objects makes them all the more absorbing.

An interesting paper-tearing trick starts with a magician displaying a sheet of paper on which

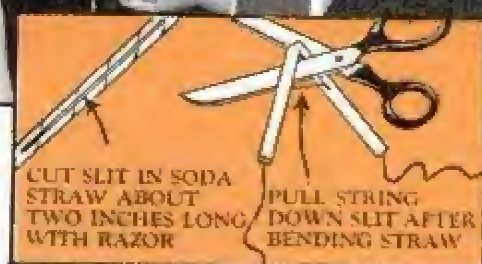


EVERYTHING



sprout is another paper-tearing trick. First, roll lengthwise six or seven double-sheeted newspapers, one at a time, overlapping each sheet about ten inches. Then flatten the roll and starting from the right side, tear down to a point a little beyond the middle. Do the same thing on the left, then rip out the center portion and discard it. Bend the leaves back, inserting a finger in the hole and pull the stalk out in telescopic fashion.

There's an intriguing trick that calls for no par-



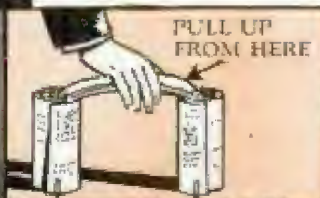
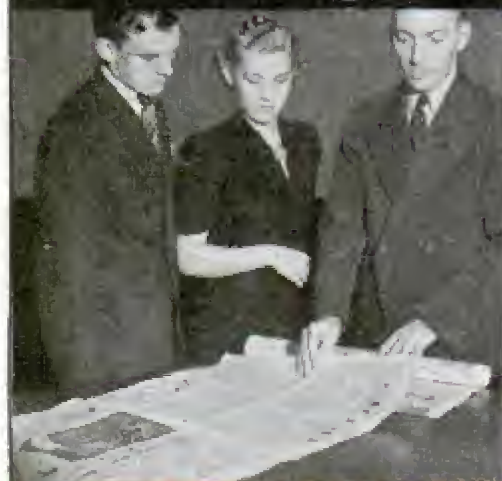
Can you change a newspaper into a stalk of corn that suddenly sprouts right up to the ceiling? The photo and diagram at top show how simply it's done. At bottom, string is threaded through straw previously prepared by slitting; before letting spectator cut straw, it is bent and string pulled out, shielded by fingers



particular magic skill, yet ranks in interest ahead of many that do. Choose a soda straw—apparently at random—and through it thread a piece of string eighteen inches long. Incidentally, the most practical way of accomplishing this is to suck the string through the straw as you would a drink. Then bend the straw in the center and ask someone in the group to cut it with scissors. After the cut is made and the straw pieces straightened, the audience discovers the string has been restored to one piece.

For this trick some advance preparation is needed. The straw you seemingly select at random is one in which you have made a one and one-half inch slit with a razor blade. In bending the straw, make sure the slit is underneath. Just before you invite a spectator to make the cut, pull the two ends of the string downward with the right hand so the string is through

At top is the ladder of newspapers. They are rolled together with ten-inch overlap as seen below; the ends clipped, center section torn out, ends bent down and ladder pulled up. Bottom, the "walking" doll



the slit. Your audience will not be any the wiser if you shield the string with your fingers.

Another paper-tearing trick is known as "Jacob's Ladder." The roll is prepared in the same manner as for the cornstalk trick. To prevent the roll from unwinding, place paper clips at either end and tear out the center portion. When

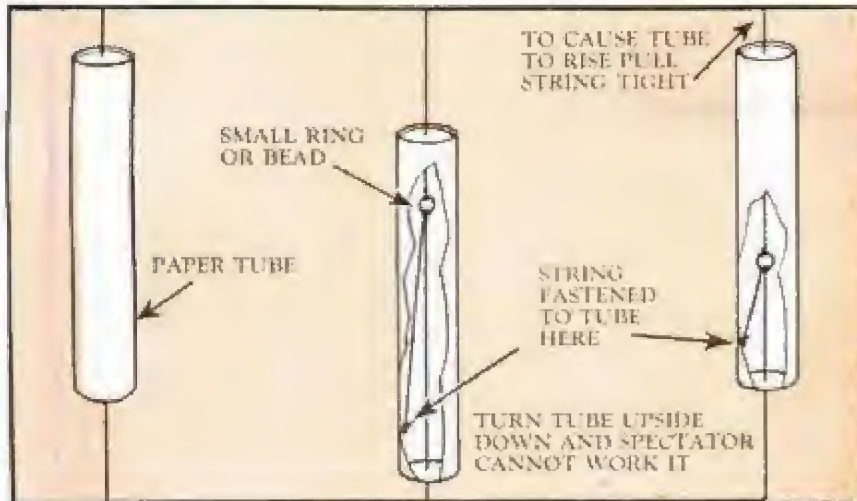


Diagram above shows how tube is prepared for stunt at right, where magician makes tube rise and fall mysteriously at his command. Below, to raise a glass without touching it, lift it with a bent straw

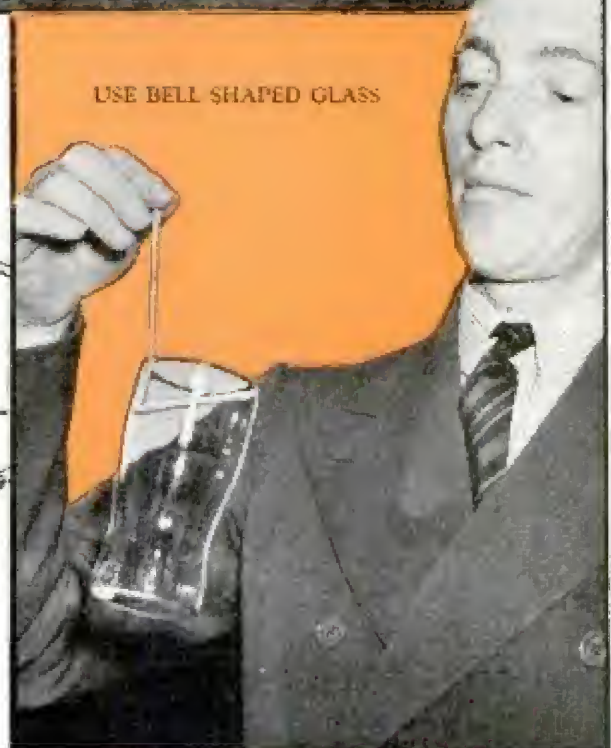
this is completed, bend the rolls downward and, grasping the paper strips between them, pull up the ladder.

Next time you are having refreshments with friends at a soda fountain, tell them you can lift an empty water glass without touching it. All you need is a bell-shaped glass and a soda straw. Before placing the straw inside the glass, bend it so it's a trifle larger than the diameter of the glass. Lift up on the straw lightly and when the end comes in contact with the lip of the glass, a wedge will be formed sufficiently strong to sustain it. On your first attempt, pick out a landing spot for the glass that's softer than a soda-fountain marble top, in the event anything goes wrong.

The controlled tube is a sure-fire hit. A magician shows a cardboard tube with a string passing through it. Holding one end of the string with his foot, he makes the tube rise or fall on the string at his command. When he hands the tube to one of the crowd, however, and suggests he do the same, the latter cannot do so.

Here, again, the crux of the trick lies in the manner in which the tube is made. Inside it, about one and one-half inches from the bottom, glue a

(Continued to page 136A)



Bicycle Made into Tandem by Adding Rear Frame



Reine
Dual bicycle, top, assembled as tandem; bottom, it is an ordinary bike when wheel replaces rear seat

Attaching an extra piece of frame and moving the rear wheel farther back makes a tandem out of a single bicycle which has been produced in Italy. A special sprocket and chain arrangement permits both riders to operate pedals.

Coil Producing Hotter Spark Is Insulated with Oil



Increased engine power and more gasoline mileage are claimed for an ignition coil insulated with circulating oil, in imitation of large electrical transformers. Oil insulation, by rapid

dissipation of heat, allows the coil to work at higher voltages and it is said to "step

up" the output to 28,000 or 30,000 volts, compared with the ordinary 15,000 to 18,000 volts, providing a hotter spark for faster starting, acceleration and hill climbing. No alterations are needed in the car except that the spark-plug gaps and the distance between distributor contacts should be increased. In tests, the new coil was reported to have functioned at 32,000 sparks per minute, whereas other coils showed signs of breaking down at 11,000 sparks. Circulation of the oil may be seen through the transparent enclosure.

Modern Soldier in Suit of Armor Resembles Knight of Old

Fully clad in all of the protective armor which is used in modern warfare, a soldier of today looks pretty much like a knight of the fifteenth century. Today's armor consists of a visored helmet with which Americans experimented during the World War, breastplate worn by German snipers, and leg and arm protectors which likewise were designed at that time. Weighing only fifty-five pounds, this armor plate, according to experts, will stop anything up to bullets from light machine guns. Compared with this, the fifteenth century knight wore 163 pounds of metal.



Reine
Armor used by modern soldier, at left, compared with jointed metal suit of fifteenth century knight

National Metal Congress and

Manchester 3
 Rumbaker Electrical Products
 13/15 Liverpool Road, Dean'sgate, England

no oil agent known

Covered Wagon Made of Wood and Concrete

Reminding tourists of America's pioneer days, a gigantic yoke of oxen, drawing a covered wagon across the plains, has been reproduced near the outskirts of Kearney, Neb. Built on a scale of one and one-half to one, the team is seven and one-half feet high, having been molded entirely by hand in concrete reinforced with steel. Wood was used for the wagon structure, the wheels, however, being encased in a layer of concrete.



Right, top, enormous proportions of oxen, fashioned in reinforced concrete, may be visualized by comparing with size of man. Bottom, wagon, also modeled on same large scale, is structure of wood with wheels encased in concrete layer



Submarine Freighter to Evade Attacks by Sea Raiders

With the ability to dive whenever it is in danger of attack, a submarine freighter has been designed by Simon Lake, inventor of the even-keel type submarine. He offers the idea to any nation friendly to the United States, for the purpose of run-

ning through blockades set up by belligerents. The underwater craft could carry 7,500 tons of cargo and have a speed of fifteen to twenty knots. Mr. Lake declared it would cost no more to build one of these than an ordinary merchant marine vessel.

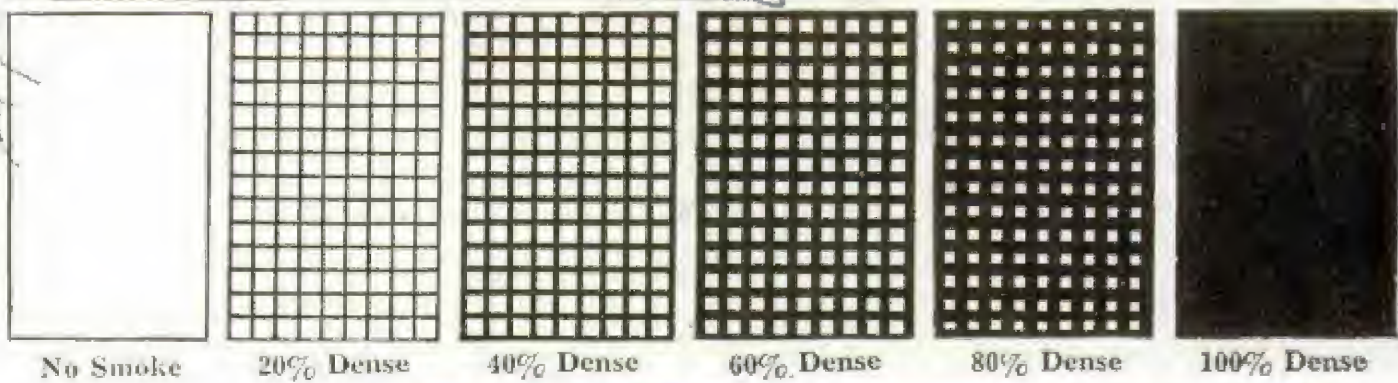


Drawing shows freight-carrying submarine which is capable of diving below surface of sea when it faces danger of attack by enemy raiders and could be built to take on a cargo of 7,500 tons

WHAT'S



Smoke density chart, below, is held fifteen or twenty feet from eye until lines converge, then compared with smoke under observation; 40-per-cent density is allowed



There's no such thing as pure air for you to breathe. Along with air, you take in a vast amount of pollen, dust and chemicals; if you happen to be a Chicagoan, you breathe an average of 47,000 particles of dust per cubic inch of air. Dust counter at upper left, collects dust on greased glass slide in front of eyepiece. In circle, dust caught in distilled water is weighed and analyzed by filtering and evaporating. Chemical, microscopic and spectrographic tests reveal calcium, magnesium, aluminum, lead, silica, iron, tin, potassium, carbon, sulphur and other elements. At right, vacuum from windshield wiper is used to collect air sample



21084

in the AIR ?



Pollution of air by dust and smoke is not only a hazard to health but indicates tremendous losses in incomplete combustion of fuel, besides the damage to brickwork and metal surfaces from corrosive gases. To supply scientific information on this problem a vast study of air pollution is being made in Chicago, with more than 400 men making street, roof-top and laboratory tests. Above, to measure dust particles, image of a sample is projected through microscope to camera at right



In circle, "shooting the sun" to measure foot-candles of sunlight. Below, adjusting apparatus to observe ultra-violet and visible-light penetration. By weighing dust collected in two jars which are partly filled with distilled water it was found that average dust-fall per month over a square mile varies from 300 tons in winter to eighty tons in summer

Carl Eugene E. Lichterman
2712 Crystal St. Chicago

Short-Wave Helmet Delivers a Radio 'Facial'

Beauty is delivered via short waves at one California beauty shop. The customer desiring a radio "facial" dons a rubber mask which looks like a wartime gas helmet but isn't; in it are concealed the ends of the antenna and ground connections of the ultra-short wave set. The high-frequency oscillations of the seven-meter set are said by the inventor to have a beneficial effect on the skin.



No gas mask, but an electric one, is the grotesque warlike helmet above. Shown with transmitting controls at right, it delivers a facial beauty treatment with ultra-short radio waves



Pilot's Safety Belt Has Springs to Absorb Shock of Crash



Injuries suffered by pilots in airplane crashes will be reduced greatly by a safety belt, worn like suspenders, which has been developed by army engineers at Wright field. It will prevent the upper part of the body from plunging into the instrument board, which usually results in severe facial injuries. The belt straps over the shoulders and is attached to the standard belt that fastens down the legs, and to absorb shock, it is equipped with springs.

Spring-equipped safety belt for pilots being tested in chair that vigorously rocks subject and turns upside down

21269 Amar Eschzales

105 Willem Ave

Camera Attached to Kite Snaps Aerial Photos

San Antonio, Texas



Anyone may take aerial photos if he cares to experiment with an idea developed by a Texan. It consists of attaching a small camera to a kite or a cluster of hydrogen-filled balloons. Because of the expense of balloons, the kite seems best for the job, although it limits the angle of shots and its struts may appear in the photo



Top, left, camera attached to balloons. Right, camera kite ready for aerial shots which neighbors frequently would like to purchase. Bottom, left, typical photo made with aid of kite. Note strut. Right, launching the kite. Frame of kite and support for camera are made of balsa wood. The camera may be operated by a timer consisting of a short string that burns up to a rubber band that releases the shutter or by a long string that permits releasing the shutter from the ground

Three Luns

*Radio plans
NBC
engineer.*

RADIO



THROUGH the medium of radio, Americans are being taken into the theater of Europe's war. Directly from the capitals of the nations involved come the voices of trained observers, each describing last-minute developments on his part of that far-flung stage of strife, and it is possible that your loud speaker soon may be roaring with the din of battle.

Portable transmitters, tested in sham battles here and abroad, offer the means of broadcasting to a shuddering world the rattle of machine guns, the shriek of shells from booming big guns and the thunder of monster tanks, with the high-pitched whine of fighting planes superimposed on the whole ear-splitting drama. Already the British Broadcasting company has moved transmitters and other equipment on wheels to the front in preparation for



Above, left, parabolic microphone aimed to pick up army band's music. Below, National Broadcasting company transmitter set into U. S. Army caisson helps in broadcast of maneuvers

GOES *to* WAR



the moment when relaxation of censorship may send announcers into the thick of an engagement.

Not long ago after the war began, listeners experienced a prelude to what may be just ahead. A foreign correspondent in Paris, discussing war problems over the National Broadcasting company's hookup in this country, was summing up: "The situation is now definite. There are no doubts—" and his voice faded out as a screeching yowl filled the Paris studio. Startled Americans hurriedly adjusted their receivers. Above the din



Top, radio setup of the type that may bring sounds of battle into the home. Center, Columbia Broadcasting system's map of its European coverage. Broken arrows denote short-wave air channels, dash-and-dot the cue facilities. Bottom, scene in New York studio, with observers listening in on foreign broadcasts. This was before fall of Poland

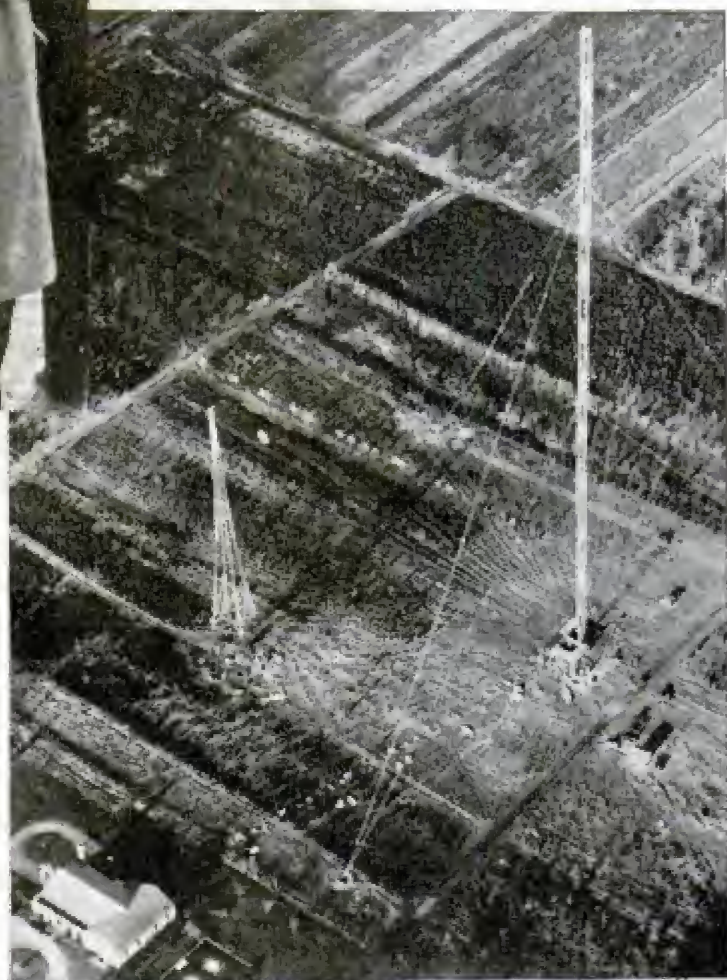


coming from the loud speakers they heard the correspondent again, fairly screaming: "The air-raid sirens are now bawling!" Then for two full minutes the terrifying wail of that alarm for Parisians to flee the danger of enemy bombing planes flashed across the Atlantic. The correspondent heeded the warning, too, and was heard no more that night.

Long before the fighting started, both NBC and Columbia Broadcasting system had their radio machines ready. Key men, trained in radio technique, had been stationed at the storm centers. Paul White, director of public affairs for Columbia, surveyed the field, and in New York technicians carried out his instructions to set up a compact arrangement for handling war news quickly and efficiently. Heart of the setup, on the seventeenth floor of the system's building, is White's office, in which an amazing battery of wires, telephones and dictagraphs permits him to cut into the network with a war bulletin in five seconds—no small achievement when you remember that there are as many as 117 stations in the hookup.

Across from this office is "Studio Nine,"

from which news analysts broadcast. It is glass-enclosed and streamlined so everyone involved in the news operation may see what is going on in every other division of the department. At one side of this studio, clearly visible through a wide glass panel, is the news room, housing tickers of the leading press associations. Last-minute bulletins can be passed through a slot in the wall to the man at the microphone without disturbing the broadcast. Just behind the news room is the com-



Left, pack transmitter in use during military ceremony. Right, giant antenna aids in bringing war news into American homes. This antenna is located in New Jersey

munications division where contact is maintained with all stations of the network at all times, and on the other side of Studio Nine is the listening station where foreign language experts listen in on European broadcasts as an extra check on picking up news tips and following developments as they are portrayed by government radios abroad.

To the rear of Studio Nine is a specially constructed control room known as the sub-master control room. In times of crisis the entire operation of the network passes through this room so that an important bulletin may be put on the air with minimum delay.

NBC likewise was ready, staff and technical facilities being keyed up far in advance of both the crisis and the war, to flash the latest news through the 176 stations in its Red



Circle, looking over war bulletins just before going on air. Center, Columbia's glass-walled studio especially designed for speeding up war news broadcasts. At left, Paul White is seen at telephone about to give cue to reporter and analyst (wearing headphones). Bottom, tuning in foreign radio stations in search of news tips

and Blue networks. Stationed at various points in Europe were observers and news directors. From London, Paris, Berlin, Rome and Geneva broadcasts traveled directly by transatlantic short-wave

(Continued to page 137A)



Mechanical Brain Aids Pilot in Checking Plan of Flight



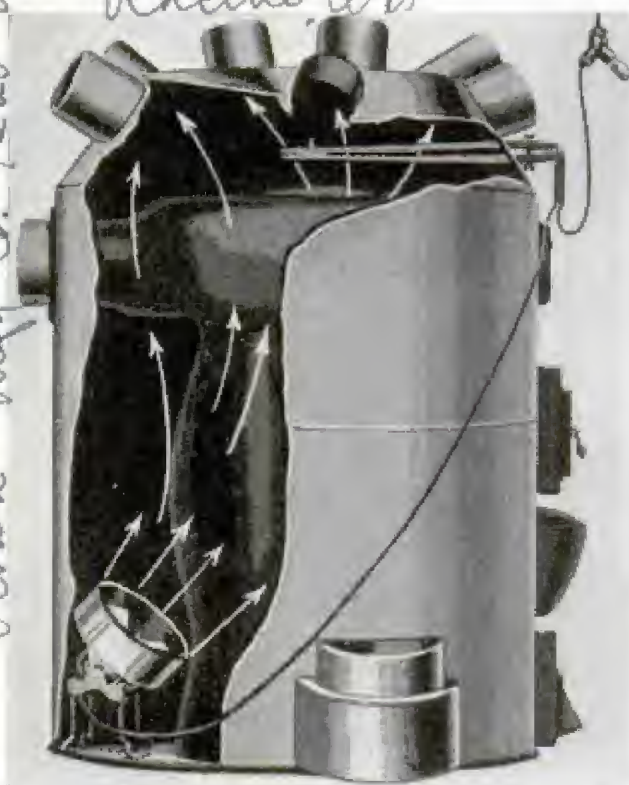
Setting pointers of mechanical brain that charts pilot's flight plan. Bottom, view of pointers

It used to take a pilot as long as forty-five minutes to complete his flight plan before stepping into his ship, but with the development of a mechanical brain the entire calculation may be made within one minute's time. The instrument, about the size of a brief case, combines into one computation many variable conditions. It is said to be very accurate. At the start of his flight, the pilot sets a series of knobs to indicate known conditions, representing such factors as wind velocity and direction, air temperature, true course of flight, total weight, time elapsed, altitude pressure, temperature at carburetor, and horsepower or engine speed. He then can read instantly every factor in his flight, including distance, ground speed, drift angle, indicated air speed, total fuel consumption, manifold pressure and engine mean effective pressure. Long flights are broken into "legs" and advance computations made for each leg. Adjustments are made by the

pilot during the flight for changed conditions immediately as they occur, and as each checking point of the course is passed he can see whether he is on time. Reports of his readings are sent periodically to the dispatcher's office, where a duplicate instrument is operated. One of the important results from the use of this mechanical brain for air lines is the assurance of landings on the minute as scheduled; and maximum engine efficiency is more easily obtained because adjustments can be made instantly to meet changing air conditions or mechanical requirements.

Fan in Furnace Air Chamber Helps Circulate "Lost" Heat

Unless heat is removed from the firebox surfaces of a hot-air furnace, this heat is often lost in the basement or goes up the chimney. To save this loss of heat, a fan now on the market is placed below the firebox in the heating chamber. By speeding circulation around all the heating surfaces the fan increases the volume of hot air delivered into the rooms. An automatic controller starts the fan when a fire is kindled, and proper speed is maintained in proportion to its temperature; then stops it when the fire is extinguished.

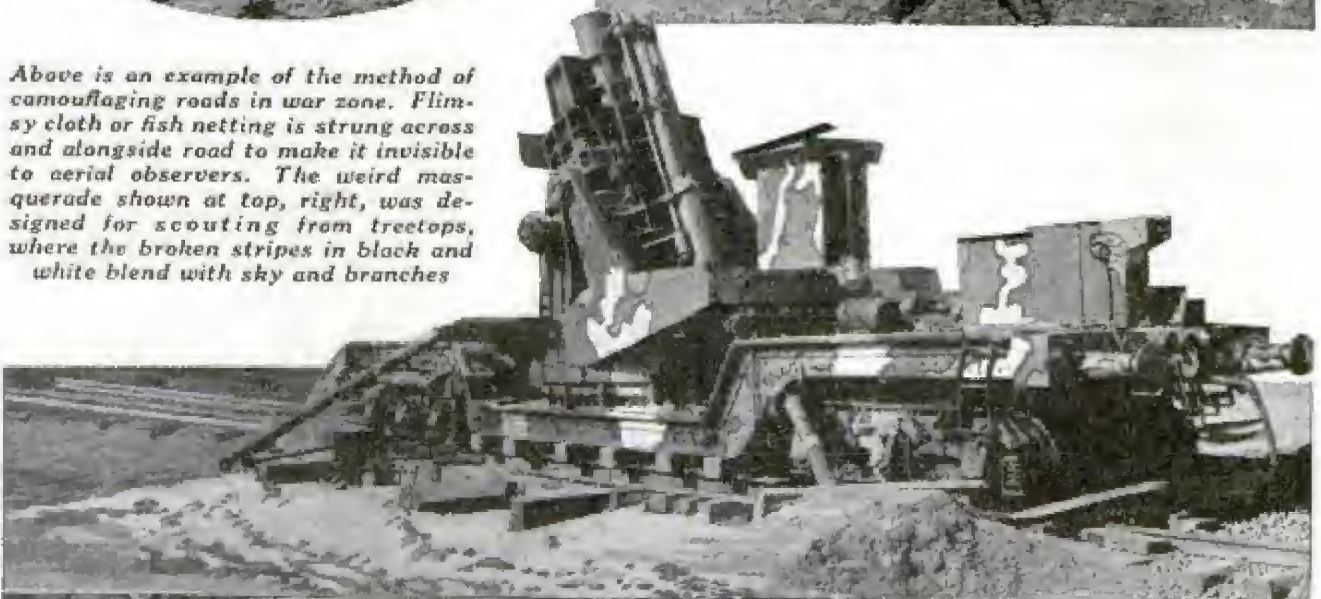


Rising current of air induced by electric fan inside furnace chamber helps circulate warmth in rooms

Camera Fights Paintbrush in Camouflage War



Above is an example of the method of camouflaging roads in war zone. Flimsy cloth or fish netting is strung across and alongside road to make it invisible to aerial observers. The weird masquerade shown at top, right, was designed for scouting from treetops, where the broken stripes in black and white blend with sky and branches



Camera and paintbrush are at war on the European battle front, where natural-color film, infrared and stereoscopic photography try to see what the enemy tries to make unseen by camouflage. The big gun, above, and plane, at left, may hide from human eyes under protective coloring but the camera detects them. Green branches stretched over the gun emplacements are soon noticed on color film or infrared picture as their leaves die. It is the job of the camouflage artist to break up outlines, to break up telltale shadows and to simulate the color of the surroundings



MODERN warfare must expect tank action in two general ways—as part of the infantry attack or as part of a true mechanized force, threatening either a wide end run to strike into vital rear areas, or exploiting a break through. Here the tank is part and parcel of another arm of the service—the cavalry. This is a horse of another color.

Again mechanical developments have forced the issue. High-speed armored vehicles are capable of striking a rapid blow, of seizing, momentarily, vital terrain, piercing a flank, threatening sensitive rear areas, and, above all, of smashing the last bit of “will to fight” out of a breaking enemy, rolling up his retreat, cutting communications, changing a stubborn retirement to headlong flight. Since all of these missions are those which in the past were logically given to horse troops, because of mobility and capability for shock action, it is only natural that the cavalry of today fall heir to the iron horse.

We call these mechanical cavalry units by several names, all

By R. Ernest Depuy

Major, U. S. Field Artillery

West Point Key

ARMY *on*

PART II

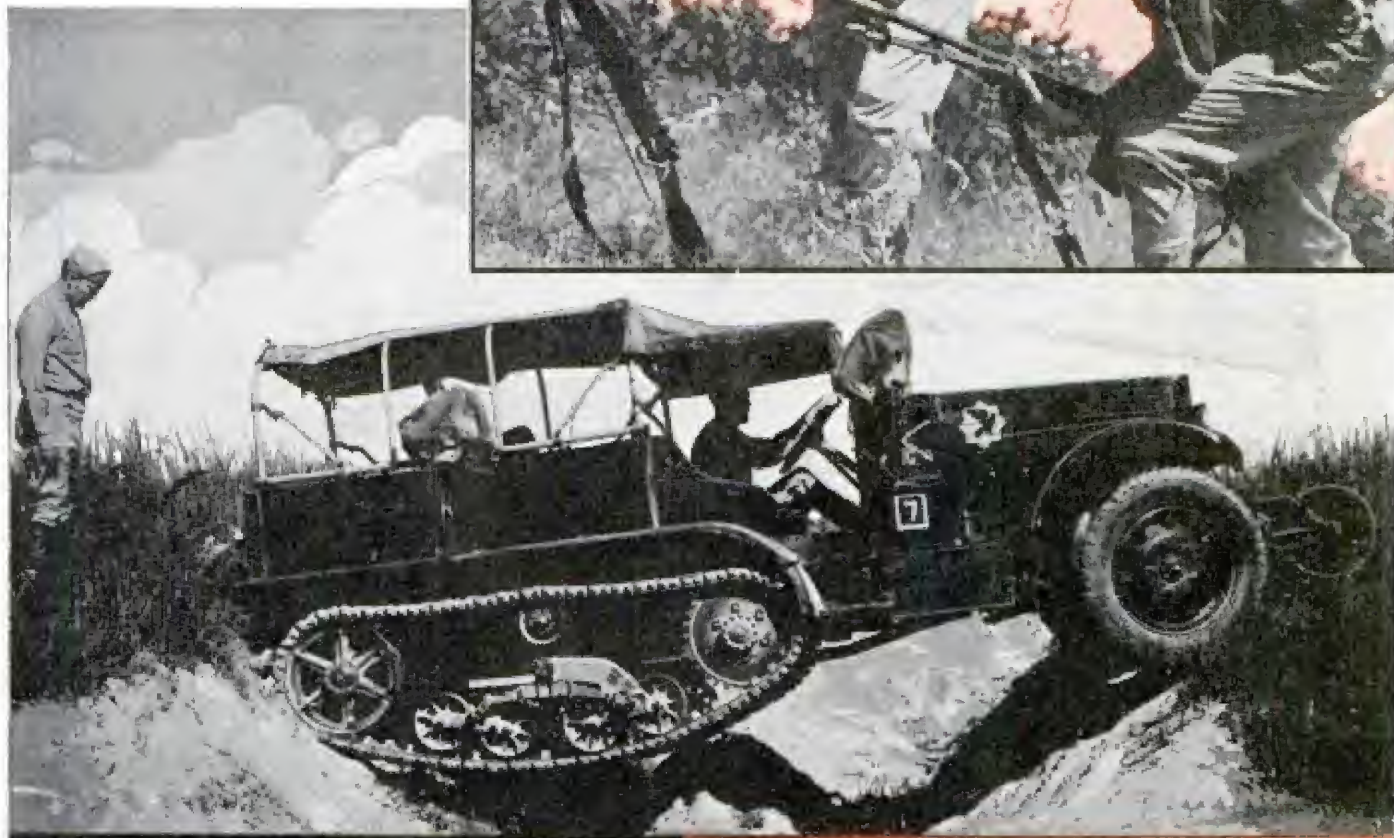


Photos courtesy U. S. Army Signal Corps

Advance of 1st Cavalry's “iron horses” (top); Thompson sub-machine gun, which is deadly at close quarters (center), and .37-millimeter anti-aircraft gun being fired at U. S. Army proving ground (bottom)

21254

*Right, modern infantry
advancing. Below, type
of vehicle used to rush
automatic weapons and
personnel to vital points.
Bottom, infantry's own
artillery, a mortar*



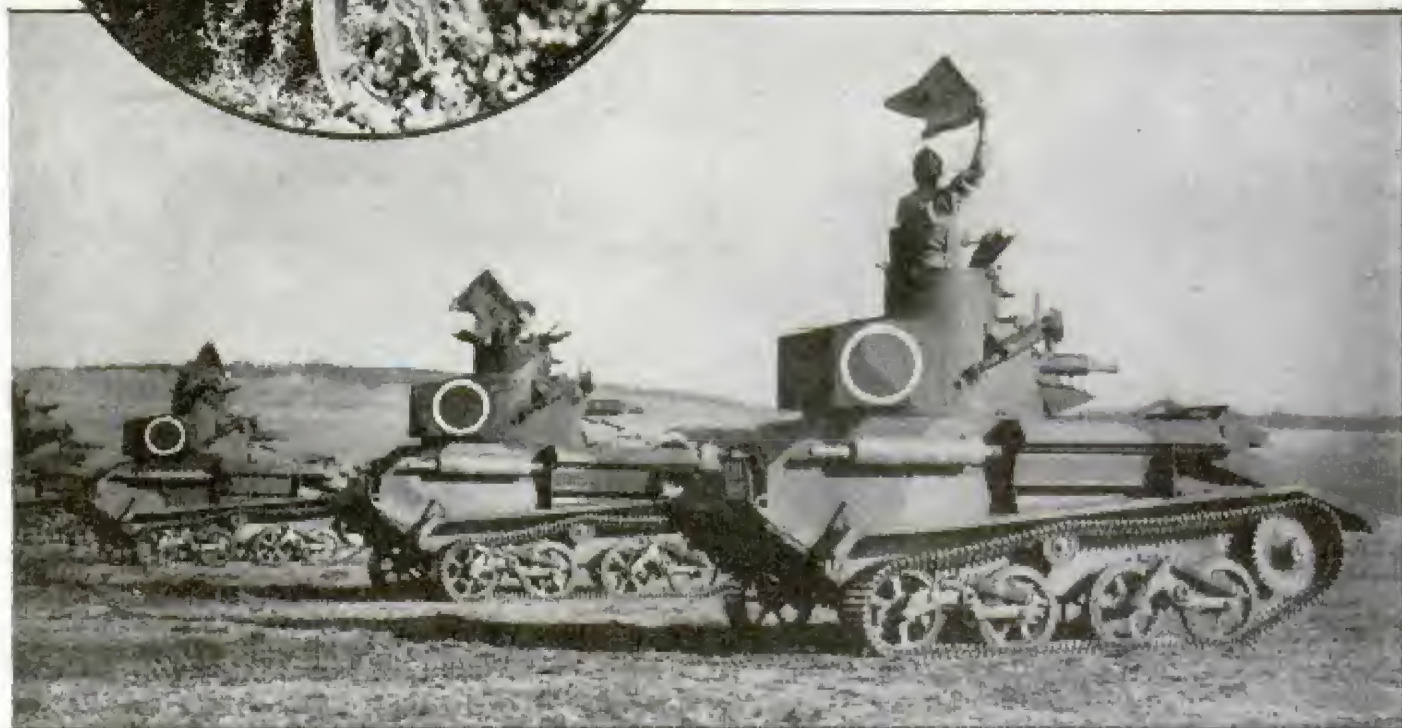
WHEELS

meaning the same thing—mechanized divisions, armored divisions, mobile divisions. They are organized in divisions, since the division is the basic self-contained unit of combat. The fighting vehicles themselves change only in name. Tank to the infantry, combat car to the cavalry, means exactly the same vehicle, exactly the same arrangement. What's in a name? The soldier who sees this roaring, fire-spitting engine of death scuttling at him across country doesn't have time or desire to bother with nomenclature. His defense against it is anti-tank defense—by artillery fire, by mine, by obstacle either artificial or natural.





leaping destroyers and light cruisers do for the battle fleet. These we call armored cars. They have slight protection to cover their occupants from small-arms fire, and carry machine guns with which to fight. But since one of the missions of the mechanized division may be to dash out, seize and hold ground somewhere, we must take foot troops along. So, we take them, mounted on trucks, in place of the mounted infantry that were sometimes used in the past to gain mobility, the mounted infantry that became dragoons. It is interesting to note that the French today call



Circle, scout car of "streamline" division. Below, some of Britain's tanks in demonstration of modern armaments. These are light tanks, moving into "action"

To date, since the mechanized division is a new weapon, we find its composition differing in the armies of the various nations, most of whom admit that they are frankly experimenting with the proportions of the various types of weapons, and vehicles, and the man power in such units. The best one can do is enumerate the various pieces of armament which are essential—the proportions may change.

Primarily we have tanks—light and medium—the striking power. Next we must have lighter and faster vehicles which can carry on reconnaissance for miles ahead, which can protect the flanks, and in general do for our land battleships what the

these motorized infantry units, "dragons portees," literally, "transported dragoons." They, of course, cannot fight from their vehicles, and it is not intended that they should thus enter the fire fight. They come to hold ground that the tanks have seized.

We need artillery, entirely aside from the light guns mounted on the tanks; we must have fire power to overcome resistance, to cover our advance, to support our infantry when they have dismounted to fight on foot. So we bring them along, motorized of course, 75-millimeter guns or howitzers—or some similar caliber. And we must have anti-tank guns to fight off enemy tank attacks, so we add a propor-

tion of them, the little wicked, fast-firing .37-millimeter or slightly larger pieces. We have to have adequate protection against aerial attack, so there must be an anti-aircraft artillery unit. We must have machine-gun units, to build up our small-arms fire power, and they are mounted in armored cars, equipped with both light and heavy machine guns and—in our service at least—with a proportion of sub-machine guns—the “Tommy guns” which are



Manning anti-aircraft machine gun (top); tanks “attacking” battery of anti-tank weapons (center), and tank advancing through a smoke screen in battle maneuvers

deadly when they are fired at short ranges.

We must add to these combat units proportions of service troops—signal corps for communications, quartermaster for supply, engineers (all important these, for they are charged with essential road-repair, bridge-strengthening and obstacle-blasting to enable our mechanical cavalry to speed on its way) and medical detachments. And we must carry sufficient supply with this service train to subsist our iron horses and iron men. Here we come to the Achilles heel of the mechanized force. It can carry on its own vehicles, both combat and transport, sufficient gasoline and oil to run for approximately two days. After that, unless it has kept in touch with its supply bases, or unless the enemy has been so sufficiently kind or suf-



ficiently frightened as to leave fuel supplies in our path, we jolt to a halt. Horses and men, animate beings with heart, can go on above and beyond their physical necessities for astounding periods. But who ever heard of a carburetor with a heart? And tanks cannot graze.

Summing up, we find in the average mechanized division a unit combining fire power and mobility, with ability to cover ground at approximately 200 miles per day, and capable normally of moving and fighting for two days without

replenishment of fuel or ammunition, across country, though with some limitations.

Visualizing the bounds that this force can make, the comparative ease with which it can be shifted from flank to flank in open warfare, the terrific punch that it carries, we see that the mechanized division is a weapon of tremendous possibilities. Not least of them is the moral effect on the other fellow, for the problem of reconnaissance and security is multiplied enormously. No longer will scattered patrols be sufficient flank or rear guard within potential range of the armored force, for its striking power will carry it through them like a bullet through paper. Troops of all arms must be diverted from normal missions to protect on all sides. We come back in effect to the days of Julius Caesar, when the Roman soldier, at the end of each day's march, actually dug himself into a fortified camp—four-square against enemy attack.



Crew of anti-tank gun, with protecting rifleman (top); "streamline" division passing in review (center), and tanks advancing across country in semblance of an attack

Ambulance Has Incubator to Carry Babies in Safety

Best conception of the strength contained in a typical armored division may be gained from a glance at the make-up of a German unit of this type—a so-called "Panzer" division. Its nucleus is a brigade of tanks, consisting of three regiments, each of two battalions of four troops—approximately 680 light and 170 medium tanks. It has a brigade of motorized infantry, consisting of three regiments each of three battalions of four companies, besides a machine-gun battalion of four companies, and a thirty-gun anti-tank artillery battery. One of the battalions in each infantry regiment is motorcycle-mounted. Its artillery consists of a battalion of twelve 105-millimeter howitzers. A reconnaissance squadron of four troops of armored cars, a signal and a pioneer battalion, and a small service train complete the unit. The division has twenty-eight light and twelve heavy armored cars. The fire power of the division, in addition to the weapons mounted on the tanks and armored cars and the 105-millimeter howitzers and anti-tank guns, consists of 260 light and 180 heavy machine guns, to which must be added the rifle companies of the infantry brigade. The estimated man strength of such a division is approximately 11,000. And Germany today is said to have six such divisions.

In our own service, true mechanization—we had tanks before, of course—started in February, 1928, with the organization of the Provisional Platoon, 1st Armored Car Troop, at Fort Myer, Va. Now our mechanized cavalry consists of the 7th Cavalry Brigade, composed of the 1st and 13th Cavalry and the 68th Field Artillery. Since an armored division should include, as stated above, a brigade of combat vehicles plus a brigade of motorized infantry and the necessary motorized field artillery, it

(Continued to page 144A)



Incubator mounted on sponge rubber mat in ambulance controls temperature and is sealed to exclude air-borne dust and dirt

Babies prematurely born have a better chance of reaching the hospital in safe and healthy condition when transported in an ambulance specially equipped with an incubator that controls temperature, excludes outside air and reduces road shocks. The incubator cabinet, which is constructed of stainless steel and fitted with airtight glass doors, receives oxygen flowing through a rubber tubing from a tank beneath. A glass funnel is attached at the end of the tube so it can be placed over the infant's face if needed. Heat for the interior is supplied by hot water from the ambulance radiator, and a thermostat controls temperatures within two or three degrees. The crib that holds the baby rests upon a heavy sponge rubber mat, to reduce shock.

Waffle Iron, Toaster and Fryer in One Has a Three-Heat Switch



Sandwiches can be toasted on an electric waffle iron by simply flipping the grids over. On one side of each grid is an iron for baking waffles, and on the other a flat grill for toasting sandwiches and for

frying. The top grid can be raised on its expansion hinge to make room for three-deck sandwiches and when opened to horizontal position it provides an additional flat frying surface.

Electric Waffle Iron, Toaster and Fryer
W. C. Mansfield

Lodge Mfg. Co. 79 00

C 1169. nagan A. Webb 145W45th, NYC

TARGET PLANE

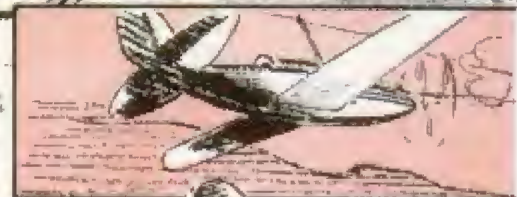
DANGEROUS, LOW-FLYING AIRPLANES BECOME LESS FEARSOME TO DOUGH-BOYS PRACTICING FIRING AT THIS TARGET PLANE



ABLE TO REACH AN ALTITUDE OF 5,000 FEET AND TO BANK AND TURN NATURALLY THIS PLANE AFFORDS A REALISTIC TARGET FOR THE MACHINE OR CAMERA GUN WITHOUT HARM TO A PILOT



SPECIALLY DESIGNED TRUCK USED FOR MOVING PLANE TO AND FROM RANGES



THE ENTIRE MANEUVERABILITY OF THE PLANE IS ACCOMPLISHED BY RADIO INSTALLATIONS CONTROLLED BY AN OFFICER WITH A SMALL DIALED INSTRUMENT

TRUCK, CATAPULT AND PARACHUTE PERMIT OPERATION OF TARGET PLANE IN MINIMUM OF SPACE AND EASY TRANSPORTATION TO GROUND BRANCHES

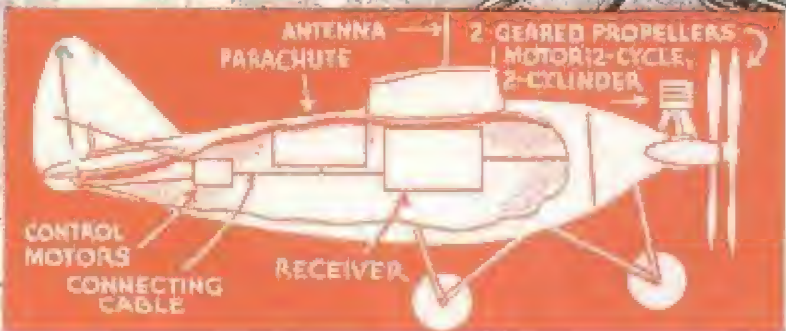
CATAPULT 30 FEET IN LENGTH

SUPPORTING CARRIAGE FACILITATES PLANE'S HEADWAY ON CATAPULT'S RAILS

RUBBER SHOCK CORDS

WIRE RUNS TO TRANSMITTER 1,000 FEET AWAY

HERE IS THE GENERAL SCHEME OF MOTIVATION

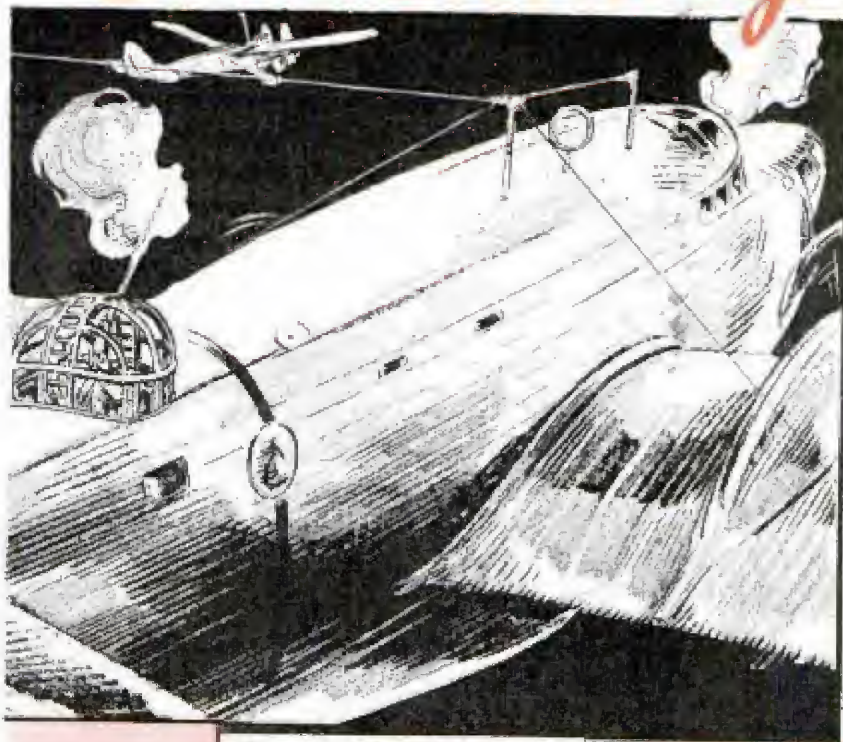


Eliminating danger to pilots, a target airplane controlled by radio is being tested by Air Corps engineers. It is designed for training infantry, cavalry and field and coast artillery in anti-aircraft work. About one-third the size of a combat plane, it replaces the old sleeve-type target towed by plane

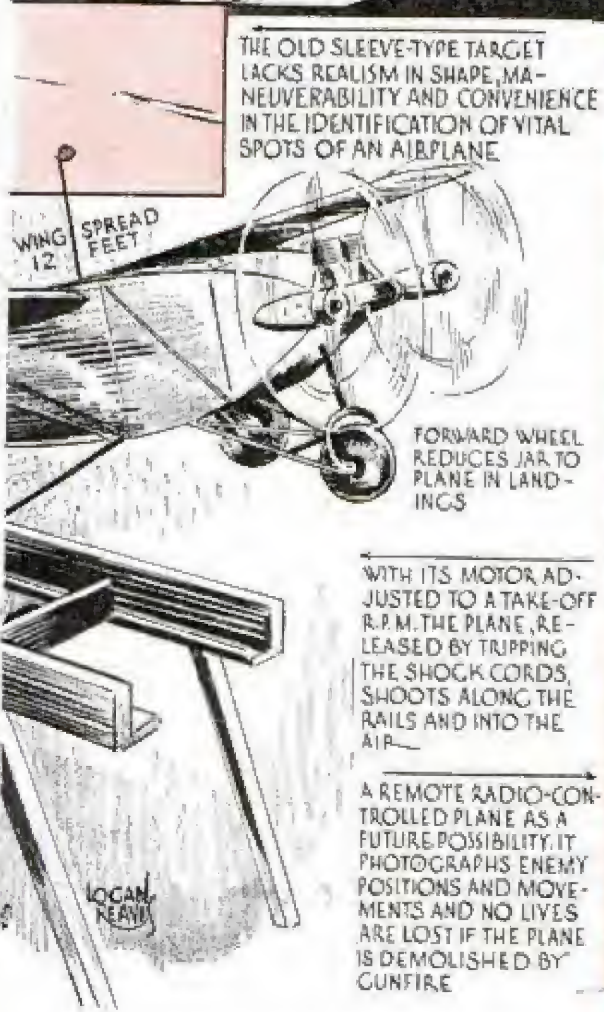
Capit. Dolloman, Capt. Fink, and Lieut. ... in development of ...

Wright Speed Dayton, Ohio

Controlled by Radio



MERE PRESSURE OF A BUTTON ON THE INSTRUMENT HELD BY THE OPERATOR STOPS THE MOTOR, RELEASES THE PARACHUTE AND THE PLANE SETTLES GENTLY TO EARTH



THE OLD SLEEVE-TYPE TARGET LACKS REALISM IN SHAPE, MANEUVERABILITY AND CONVENIENCE IN THE IDENTIFICATION OF VITAL SPOTS OF AN AIRPLANE

FORWARD WHEEL REDUCES JAR TO PLANE IN LANDINGS

WITH ITS MOTOR ADJUSTED TO A TAKE-OFF R.P.M. THE PLANE, RELEASED BY TRIPPING THE SHOCK CORDS, SHOOTS ALONG THE RAILS AND INTO THE AIR

A REMOTE RADIO-CONTROLLED PLANE AS A FUTURE POSSIBILITY. IT PHOTOGRAPHS ENEMY POSITIONS AND MOVEMENTS AND NO LIVES ARE LOST IF THE PLANE IS DEMOLISHED BY GUNFIRE



Launched by catapult, the target plane attains an altitude of 5,000 feet and can turn and bank in realistic manner. Construction and maintenance costs are low. In addition to serving as a target for practice gunnery, it might be used for photographing enemy positions without loss of life if it should be destroyed

Chart Plots Danger of Fire from Forest Conditions



Relative danger of forest fire is plotted daily on this board after obtaining weather reports

Forest fire danger is plotted from day to day on a chart that takes into consideration the various factors increasing or reducing the hazard at the moment—the relative humidity, wind, recent rains, fuel moisture, growth stage of trees and plants, and so on. Reports from the nearest weather bureau are tabulated on a special slide rule and transferred numerically to the fire-danger board three times a day. At the top of the board appears the number representing the current fire hazard. Number one will indicate no danger, with high humidity, green woods, the wind calm, visibility unlimited and fuel moisture not over twenty-five per cent. Extreme danger is indicated by number seven.

U. S. Aircraft Plants Speed Up to 15,000 per Year Pace

Swift expansion of airplane manufacturing facilities in the United States during recent months has brought production ca-

capacity to 1,250 planes a month, 15,000 a year. Building projects under way will make possible even greater production. Of the forty-three manufacturers included in the survey, twenty-three are busy on military equipment. While airplane factory space was increasing from 6,000,000 to 7,025,000 square feet in the first half of 1939, an expansion of seventeen per cent, aircraft engine factory space reached 1,975,434 square feet for a twenty per cent gain in six months. The thirteen American engine manufacturers can build 16,000 engines a year.

Soldiers Given New Uniforms and Semi-Automatic Rifles

Semi-automatic rifles and more comfortable uniforms are included in the United States army's new equipment. The old Springfield rifles are being replaced by the new gun invented by John C. Garand which works on the principle of a Colt automatic pistol. Clips holding eight thirty-caliber cartridges are inserted by hand, and twelve clips per minute can be fired by an expert. A rod operated by gas works



Soldier at right wearing new uniform bears semi-automatic rifle, as compared with old equipment

the breech mechanism, and an entire clip can be fired without removing the rifle from the shoulder. The Garand gun is said to have a fire power equal to three Springfields.

Slingshot Used as Gun by Expert Marksman



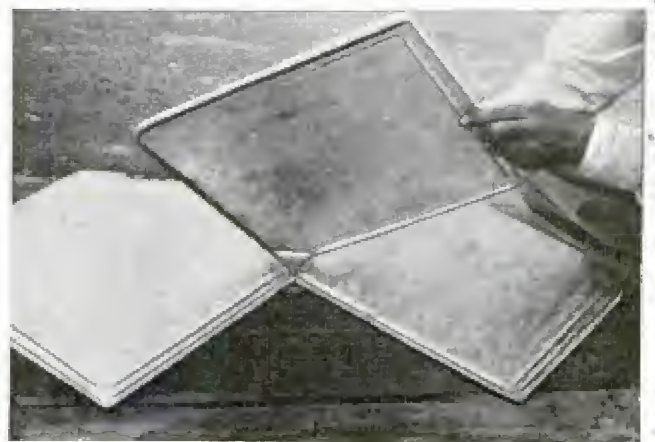
Two pictures at left show slingshot marksman shattering clay pigeon. Above, the expert flicks ashes from cigar with pellet; below, taking careful aim

Accuracy with a slingshot that rivals tricks performed with a pistol has been developed by a Tennessee marksman. Using a slingshot consisting of a forked stick and two stout rubber bands, he shoots the ash from a cigar held in someone's mouth.

hits clay pigeons thrown into the air, or lights two matches by striking them with a pebble. He makes a living partly by hunting, and boasts that he has never brought in a wounded duck since he always hits them in the head.

J.R. 65 Charles Taylor, Reelfoot Lake
Interlocking Steel Shingle Ventilates Roof to Avoid Rust

Hexagonal steel shingles with watertight interlocking connections that permit air circulation underneath have just been introduced. Built so simply that an experienced roofer is not required for installing them, these shingles are ultra-rigid and durable. The ventilation feature eliminates "sweating" and the resultant rusting. If a shingle is damaged it can be replaced by prying loose the interlocking connections, and if a building were wrecked the entire steel-shingled roof could be removed and used again.



Watertight interlocking shingle lets air circulate

*Chas. Taylor - R.C. Harrington
 Build Line & Cement © 1904 W.*



The YOUNG GIANT

By Coach Sam Barry
University of Southern California

91060

MORE people will watch basketball games this year than any other sport. Judging by last year's figures some 100,000,000 spectators, about a third more than the total football attendance, will watch the indoor game this winter.

University Park, Los Angeles, Calif

Three or four years ago basketball was just another sport and its sudden rise to the top is because its mechanics have been changed from a defensive to an offensive sort. The game has been tremendously speeded up. Elimination of the tip-off, on

which the writer experimented for several years before it was adopted, makes larger scores possible. The ten-second rule that calls for the ball to be advanced to the center of the floor within ten seconds after it goes out of bounds or under certain other circumstances, as well as the three-second rule that allows a player to stay inside the free-throw area only for that length of



Top, good defense tactics, with each player paired against opponent. Bottom, guarding practice trains players to get control of ball from opposing players

Pauline Palisades, Calif

*cont. Thomas & Stinson Dr.
18618 Malibu Road*



time have added to the speed and versatility of basketball. It always was a fast game and the recent changes have made it faster and trickier than ever.

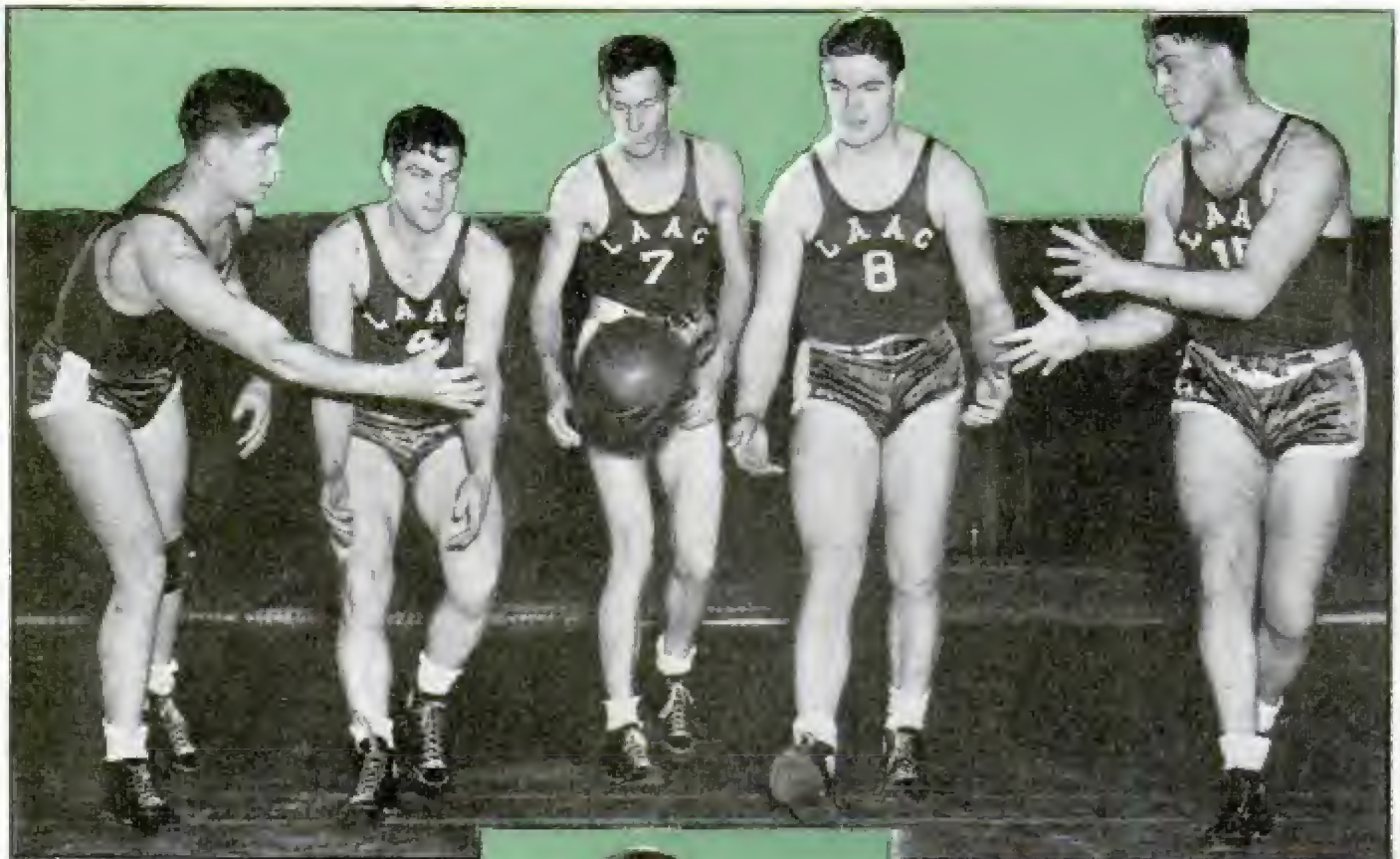
For a while we thought the strenuous exertions of the modern game might be too hard on a player but scientific tests show that forty minutes of fast play is easier on him than a fast quarter-mile run.

Strategy has become an important factor and a team is apt to try deliberately to decoy opponents out of position

of SPORT

Top, player getting away good distance shot, causing ball to spin with motion of thumbs. Center, showing how player's hands impart spin for long straight flight of ball. Bottom, left, tipping ball into basket. Right, forward and guard in close quarters

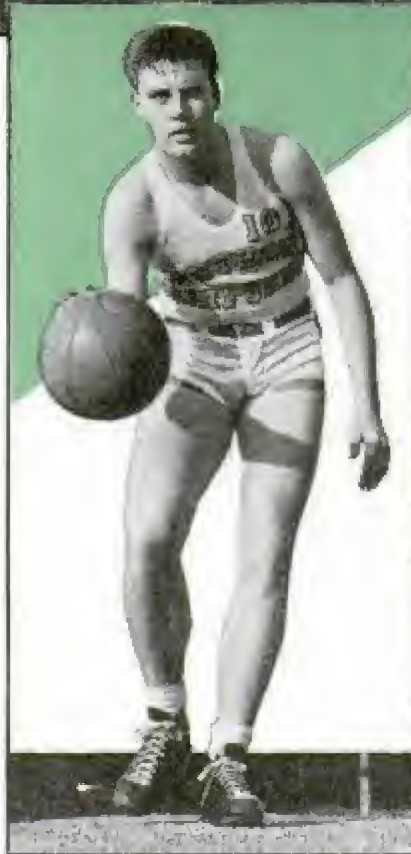




and then, when the stage is set, make a fast drive down the court. Various formations for different plays are used and a ball may be handled by five or six players in maneuvering for a shot.

As time goes on more changes may be made in the rules. Officials are studying the advisability of reducing the length of the official floor from ninety-four to eighty-five feet. Now that the tip-off is no longer used the long floor doesn't seem necessary. Another suggestion is to raise the baskets two feet, to a height of twelve feet above the floor, as a way to reduce the advantage tall men now enjoy over shorter players.

If you can place one out of every four shots in the basket you are a good shooter. The way to hold the ball for a long shot is with both hands on the back half of it, thumbs extended and almost together. The ball is pushed into the air and much of the work is done by the thumbs, which are shot forward and downward in making the throw. It is a natural motion



Learning control of ball by juggling from one player to another and (left) dribbling, with head up to watch opponents. This is considered good form

and an important one. The downward motion of the thumbs puts "english" on the ball and causes it to rotate inwardly, giving it the same spin that you give a baseball in throwing a straight pitch.

Try throwing a long basket by pushing the ball with the palms and fingers alone. You'll notice that the ball is dead, that it falls short and that it wobbles in the air. Then put a spin on your next shot and watch how it flies straight toward the basket. The spin prevents

side waver and gives you better control. Spinning in a direction opposite to the rotation of a wheel along the ground, the top of the big ball travels backward through the air while its bottom is rolling forward and is building up air pressure that tends to make the ball skid upward. That's why you get better distance with a spinning

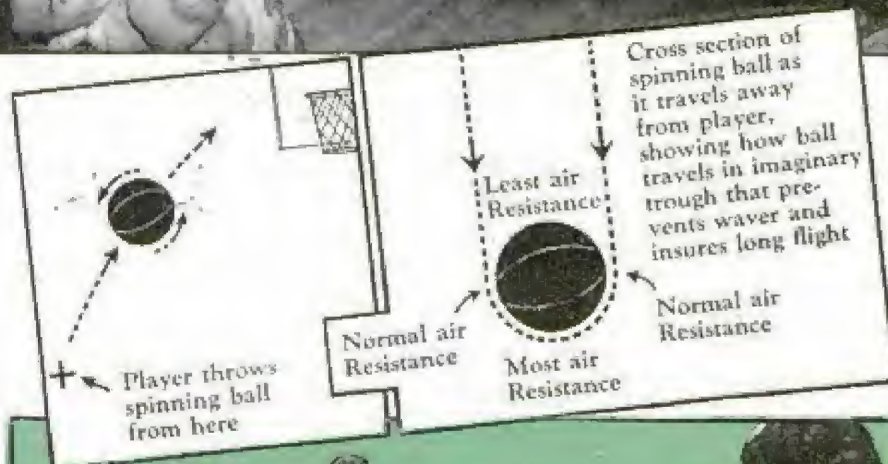


ball. Since the least air pressure is at the top of the ball there is no tendency for it to fly off to one side, and this accounts for its straight flight.

Use this two-handed throw for long-range tosses up to forty or fifty feet. For short throws, when you are within fifteen feet of the basket, one hand is all you need. This is a push shot and you float the ball toward the basket very much like you were making a shot put. Rotation is not necessary for the short distance the ball travels.

Although shooting is the most important fundamental of the game, you won't be a good player until you learn a number of other phases. Most shots fall off the rim instead of falling through the hoop and you should always be prepared for another try at making a score. This is mainly a

(Continued to page 122A)



Top, left, tip-in shots are easy for player who times himself properly. Right, practicing one-hand push shots. Center, demonstrating effect of air resistance on spinning ball. Bottom, players posed by coach in working out trick play

Safety-Belt Shock Absorber Breaks Worker's Fall



Testing shock absorber in leap from tower, and, below, placing rope in device that breaks man's fall

Men working in high places where they face the risk of injury or death by falling, now may use a shock absorber which protects them in case of accident. The worker wears a woven harness to which a rope is attached. This rope passes through the shock absorber, which in turn is fastened to the structure. If the workman falls, the shock absorber acts as a brake by clamping down on the rope and slowing the

plunge until the man comes to a gradual stop. If he were to fall unchecked for the full length of the rope, the force might snap the rope when its limit was reached, or the sudden jerk might cause injury.

Handy Card File in Automobile Slides under Front Panel

Salesmen with large lists of prospects or voluminous sales data will recognize the convenience of a card file that is installed in the automobile, under the instrument board. It holds 750 standard three-by-five index cards and is equipped with a handle and sliding cover to be used in carrying the case into a prospect's home or office. With the cover on, the container may be pulled out like a drawer to serve as a small writing desk.



Tool Inserts Expander in Piston without Removal from Engine

Installation of piston expanders has been simplified by the development of a spring-steel one that can be placed without removing either the pin, rod or piston from the cylinder. Furnished with each set of expanders, a special tool, resembling pliers with prongs instead of pincers, is used in placing them, and no grooving, drilling, slotting or other machining is required.



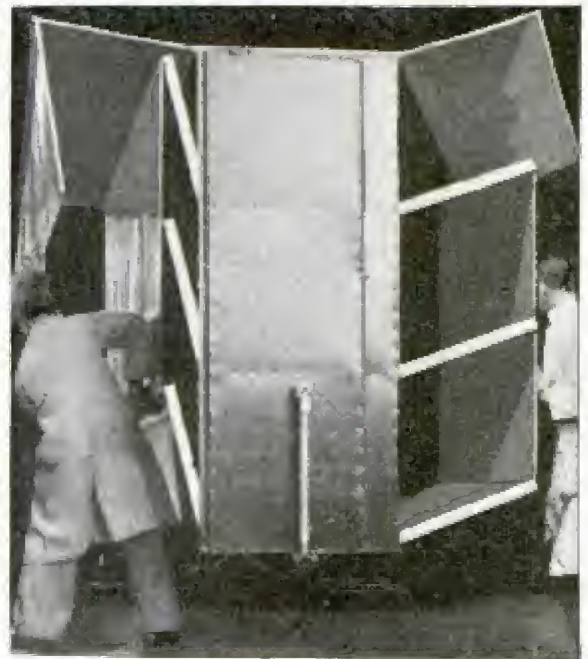
Spring-steel expander is placed in piston while it is in the cylinder and without removing rod or pin

The Web-Lover Piston
Boring Co.

London Is Ready for 'Blackout' Emergencies



Above, farm horses wear electric headlamps for protection on darkened country roads. Right, mounted constable uses two-way radio to direct crowds and talk with headquarters



At left, center, auxiliary fire unit with its own emergency reservoir prepares for air-raid service in London. Below, taxicab is commandeered to haul trailer pump of fire-fighting group. Right, collapsible trailer ambulance which can hold twelve injured persons on folding stretchers while nurse patrols center passage. When collapsed it is only two feet four inches wide and can be pushed through a narrow lane when the road is impassable

Paul Connor,
705 Santa Barbara Road
Berkeley, Calif.

The ROOKIE Goes to



Left, the rookie is given instruction in electricity, if he wants it. Right, here he learns how to operate an anti-aircraft fire director. Below, the army band offers opportunities to the musically inclined recruit



227,000 men—the largest peacetime military strength America has ever seen. And one important thing about this new army is that beef and brawn don't count like they used to. Modern wars are fought with civilization's most intricate instruments, and soldiers have to know how to use them. So the day of the dumb soldier is gone.

"WHAT I want to know," the red-haired, freckle-faced youth said, "is do you learn anything in this army besides how to shoot guys."

The recruiting sergeant grinned and replied: "You bet you learn something in this army besides how to shoot guys. Today's army is streamlined and technical, and they won't even let you enlist unless you can prove you have the necessary brains to learn with."

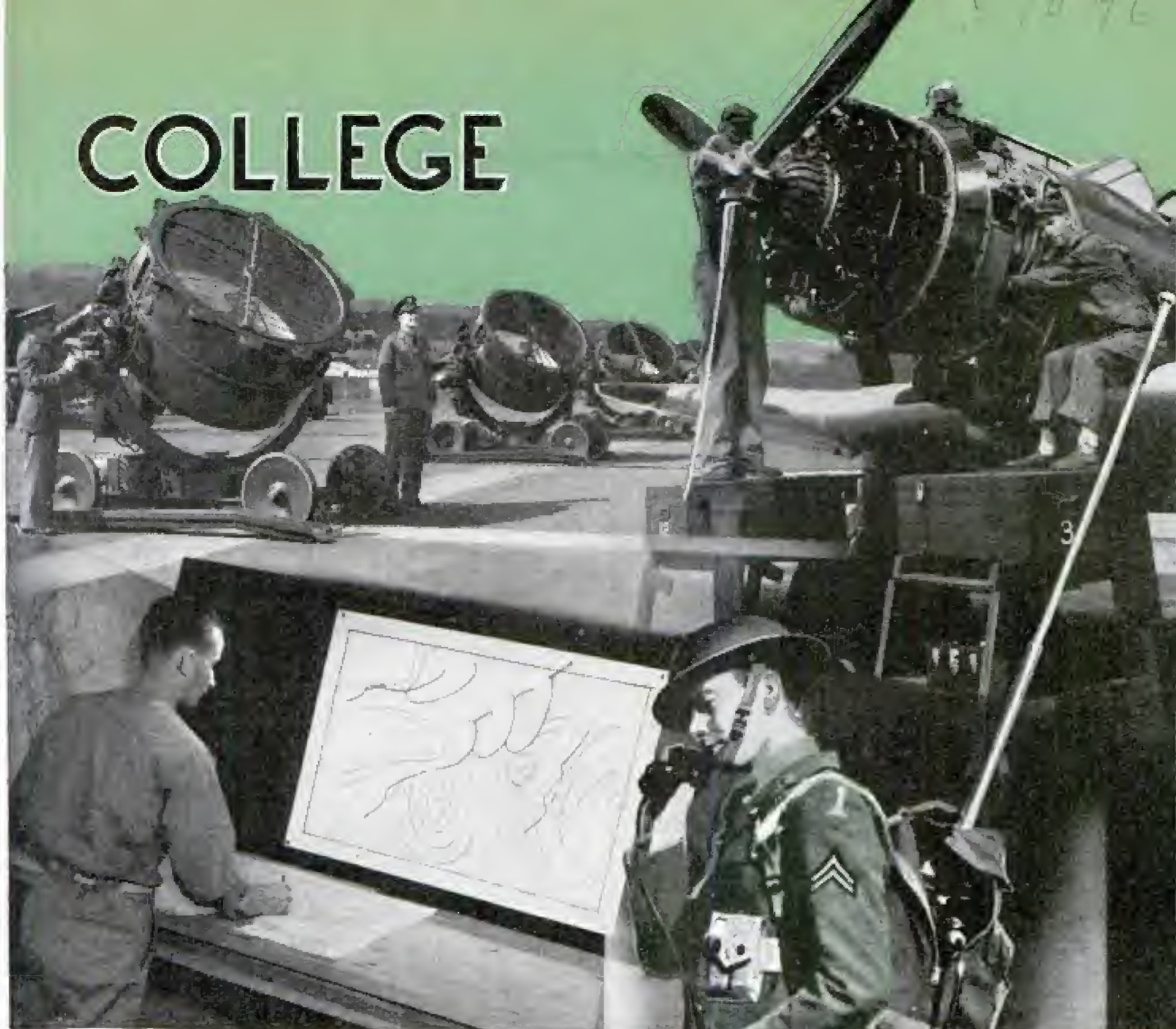
Uncle Sam is in the midst of a campaign to build up the regular army to a total of

in today's army. Standards for enlistment are higher. The recruit must present a good school record, and if he's ever been in trouble with the police the army won't take him as a gift.

Suppose our red-haired boy is among the thousands of new men now being sworn in. Where can he go, what can he see, what can he learn?

We'll assume he hasn't a police record, and that he gets checked through with a physical O.K. He's at least five feet four inches tall, not under 115 pounds, has av-

COLLEGE



Top, operating giant searchlights in the coast artillery and (right) servicing an attack plane. Center, drawing a weather map. Bottom, using short-wave radiophone developed by the signal corps

erage eyes and sound teeth, and is between the ages of eighteen and thirty-five. His I.Q. shows his brains are all there. Then, before he takes his oath, he has an opportunity to pick a definite place to serve and a specific branch of service. As to the place, he can go nearly anywhere in the United States, to the Canal Zone, to Hawaii, to Alaska, and to the Philippines. As to the branch of service, he may choose the Air Corps, Cavalry, Chemical Warfare Service, Coast Artillery Corps, Corps of Engineers, Field Artillery, Finance Department, Infantry, Medical Department, Ordnance Department, or the Signal Corps.

Encompassed in the army's various arms and services is every kind of pursuit to be found in civil life, plus many specialized and strictly military activities. There are





Top, the recruit learns how to pack a parachute. Center, artillery instrument corporal gets the range for the big guns. Bottom, learning to operate a field radio is another opportunity offered the young soldier

places for stenographers, newspapermen, artists, draftsmen, surveyors, X-ray technicians, photographers, cooks, bakers, precision machinists, metal workers, weather forecasters, veterinarians, radio operators and technicians, chemists, sign-painters, plumbers, accountants, airplane mechanics, storekeepers, and even salesmen, such as the recruiting service itself. Each of the army's branches maintains fine schools, where the necessary training is administered with the systematic thoroughness that is one of the army's finest characteristics.

Suppose our red-haired recruit decides to give the Air Corps a whirl. He enlists for one of the regular units overseas or in "The States." After he gets to his field, whether his unit is bombardment, attack, pursuit or observation, he'll go through a basic course of instruction, a sort of a shaking-down process. When this is over, he'll be assigned to the kind of work for which he seems best fitted.

The Air Corps, of course, has fascinating possibilities. They include aerial photography, airplane engine and airplane maintenance, armament and machine shop work, meteorology, parachute rigging, radio operation and maintenance, sheet metalcraft, welding—and even traffic dispatching. Enlisted men are not pilots, but those properly qualified may be sent to Randolph Field, "West Point of the Air," where they are turned out as officers and fliers. However, they get plenty of passenger-flying as observers, as aerial cameramen, as radio operators, and as mechanical checkers on test flights. Each year about 500 outstanding men, selected from Air Corps stations throughout the army, are sent to the Air Corps Technical School at Chanute Field, Ill., one of the finest aviation schools in the world.

If there's such a thing as a second choice, the rookie might look

over the Signal Corps. This is also a highly technical branch, offering training of great value in civil life. Nerve system of the army, it includes every kind of communication known to man, even carrier pigeons. This corps installs and maintains telephone systems, runs a vast and intricate wireless network, and is also the army's official photographer. Assignments available in this corps include telephone electricians, linemen, switchboard operators, teletype maintenance men, radio operators, radio repairmen, and others as diverse as the communications industry itself. Army radio operators are on all the big army transports plying the Atlantic and the Pacific, and they're scattered ashore all along the line. Alaska is connected with The States by army radio men of the Signal Corps, who supply much valuable data enabling accurate weather forecasts.

The Signal Corps, like the Air Corps, maintains a school. It is at Fort Monmouth, N. J., and qualified enlisted men are sent there every year for systematic training.

One branch of the army that's closely allied with civil projects is the Corps of Engineers. Army engineers built the Panama Canal, miles upon miles of Mississippi levees, they're building the great Fort Peck Dam, and they have constant supervision over America's navigable rivers and harbors. If the

(Continued to page 124A)



Top, you can become an X-ray technician in the army. Center, Signal Corps' mobile pigeon loft. Handling pigeons as message-carriers is only one phase of Signal Corps work. Bottom, teletype maintenance courses also are offered by some of the many schools operated by the army

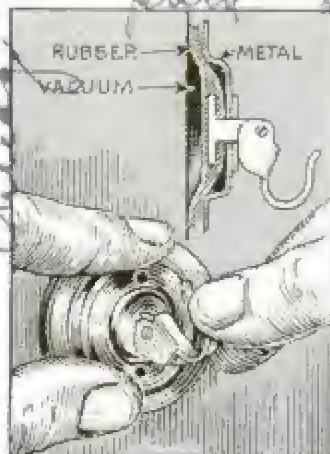
Interlocking Weatherstrip Is Tacked on Quickly



It is easy to nail weatherstrip on window frame and sash. Below, interlocking sections keep out wind

Simplicity of application is the outstanding feature of an all-metal interlocking weatherstrip now on the market. An air lock in the stripping keeps out wind, dust and rain, and prevents heat loss. It may be installed without removing sash.

Clothes Hook with Vacuum Lock Attached Firmly to Any Wall



A clothes hook with a vacuum lock requires no pressing or forcing in fastening it to the wall. Simply hold the rubber cup firmly against the surface, pull the hook down and it will stay indefinitely. The hook serves

as a lever to help build up vacuum by drawing the center of the cup inward, while contact at the circular edge keeps air out. It can be attached to car windows, and a clip in place of the hook converts it into a holder for calendars and advertising cards. It also can be equipped for use as a soap dish or tumbler receptacle.

Suede Beanbag Ash Tray Can't Be Tipped Over

Housewives accustomed to sweeping ashes from the rug will appreciate the non-capsizable ash tray. It's a tray fitted into a beanbag, the bag being of suede leather filled with shot. Set it on your knee or a chair arm and it will "stay put."



Telescope Is Mounted on Auto to Sell a Peek at Prison

Mounted on an automobile parked across the water from Alcatraz penitentiary, is a telescope through which passersby may take a peek at the island prison in San Francisco Bay. The nine-inch refractor, with seventy to 700 magnification, depending on the objective used, is balanced so as not to interfere with driving.

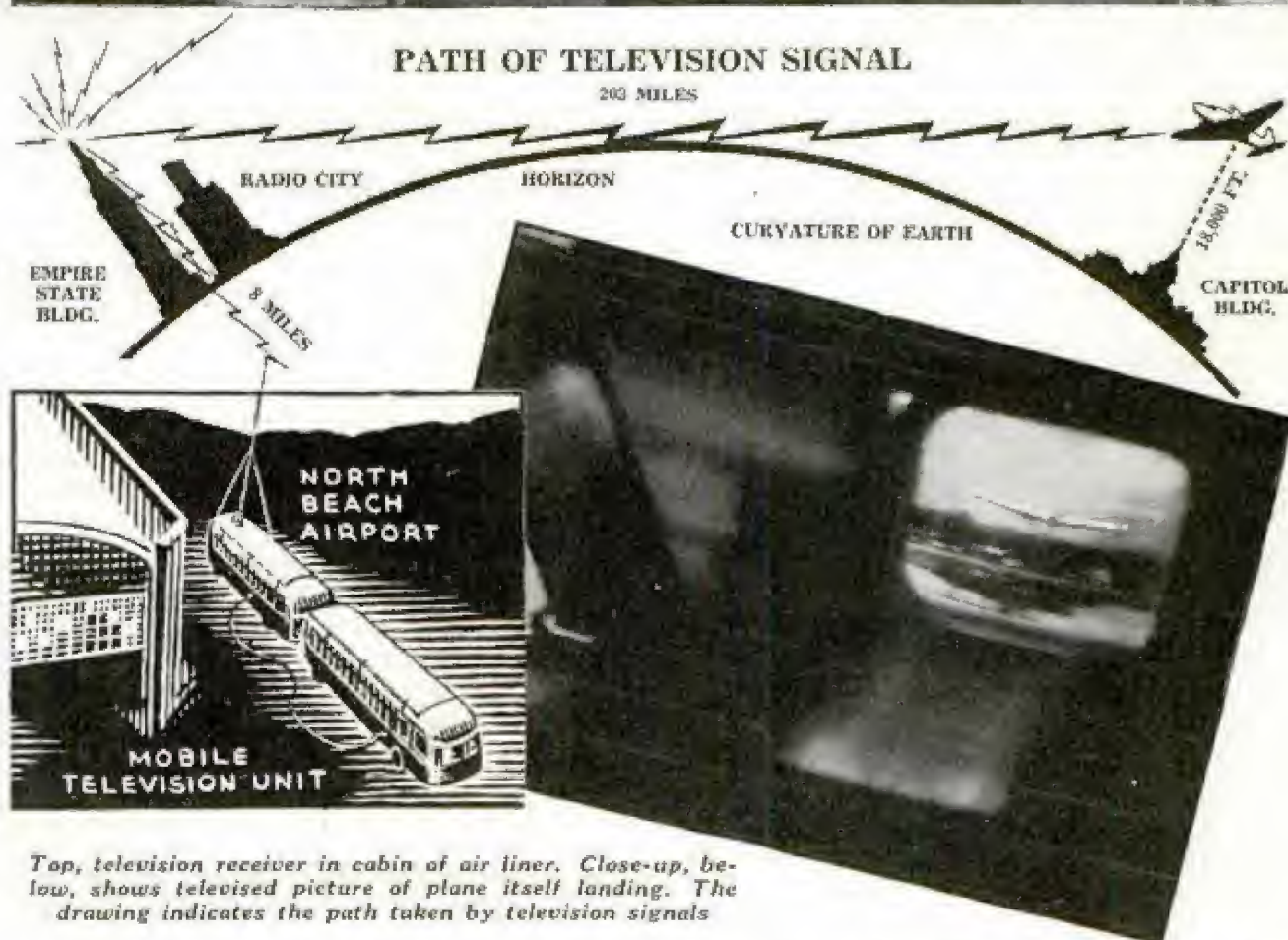


Tourists peek at Alcatraz penitentiary, in distance at right, through this telescope mounted on car

Ref: John Jansen, 370 S. San Francisco, Calif.

United Air Lines

Fliers Watch Own Plane Land by Television



Top, television receiver in cabin of air liner. Close-up, below, shows televised picture of plane itself landing. The drawing indicates the path taken by television signals

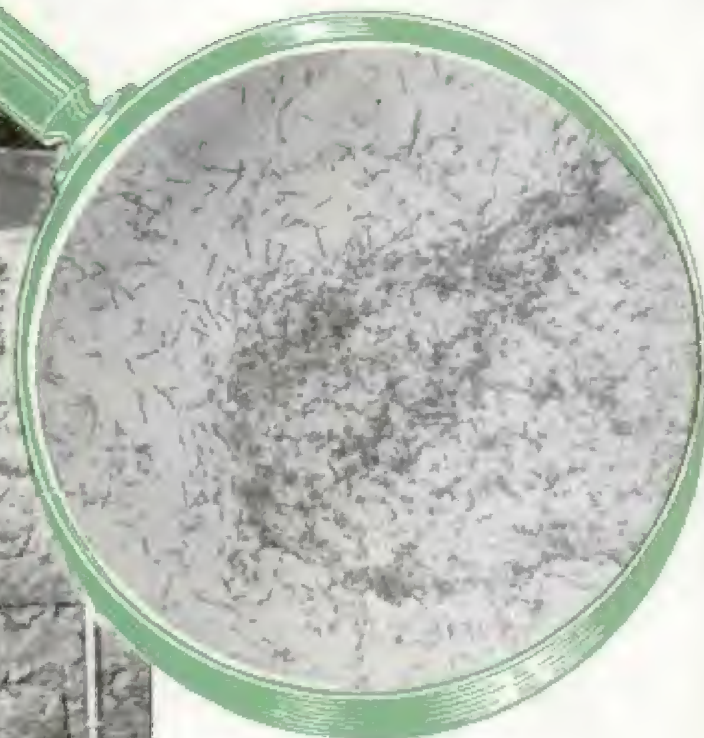
It was only a stunt when passengers in an airplane the other day watched on a television screen the landing of their own ship, but it was a stunt that presaged range-finding of military targets by aerial television and perhaps new methods of "blind" landing. The United Air liner was 21,000 feet above Washington. In its cabin a television receiver reproduced images broadcast from Radio City, 200 miles away.

Later, as the plane circled New York's North Beach airport and then landed, the picture on its screen was that of the plane itself. Looking into the future, engineers suggest that some day a television receiver in the cockpit might guide the pilot to land in thick weather. And it may be possible to send up an observation plane to photograph a military objective and transmit television pictures to the artillery.

21090

Cont. of the report made
457 at Serrano Ave
Los Angeles, Calif

HOW LONG CAN

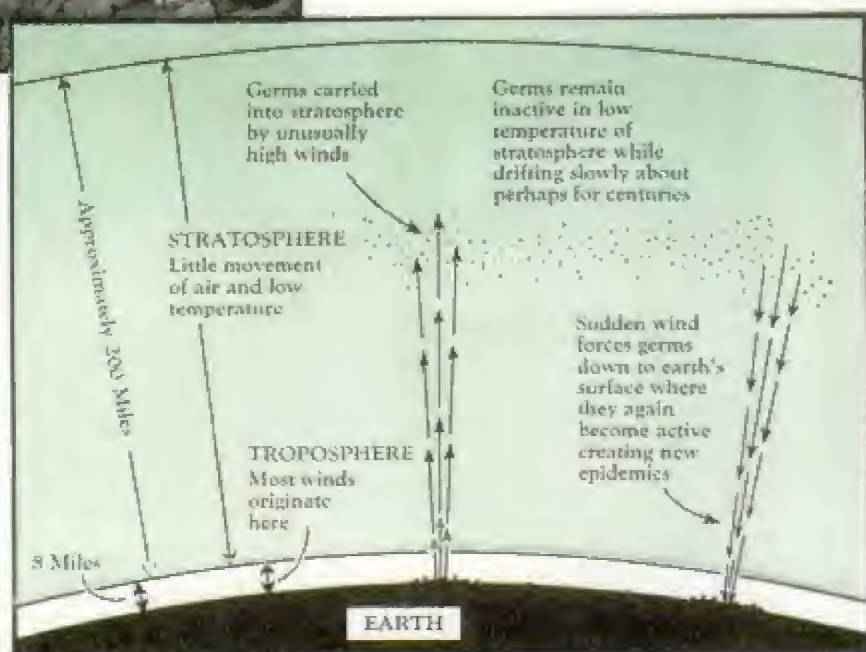


Left, taking specimen with sterile coring auger from wall of 165-year-old mission at San Luis Obispo, Calif. Above, microscopic picture of germs revived after 1,000-year "sleep" in wall of Montezuma Castle, Arizona

INSIDE the test tube a murky cloud is gathering—sleep that began before the Egyptian pyramids were built is ending. For 5,000 years organisms have lain dormant, sealed within a thick wall, cut off from light, air, food, or moisture.

These organisms are bacteria and tiny one-celled spores; the startling discovery that they are potentially deathless is the result of the painstaking experiments of a California doctor. And the upshot of it all is that some of science's most intriguing questions are due for new answers.

How long can germs really live?



Finding of inert germs in stratosphere by National Geographic Society expedition suggests, as illustrated by diagram, that epidemics are caused by down winds bringing bacteria to earth

2. 1090

GERMS LIVE?

Bacteria were revived from material sealed 5,000 years in Mexican Pyramid of the Sun, right. Below, flaming wall to prevent contamination before boring specimen. Bottom, sequoias, considered oldest living things, may yield that crown to germs



Can living things lie dormant, for centuries, even millenniums, and yet return to normal life when conditions again become favorable? Have great epidemics been caused by disease germs which drifted high in the stratosphere, dormant, but ready to resume their deadly work when a down current of air brought them to earth? These questions have inspired a thousand experiments. The latest of these, performed by Dr. Ira B. Bartle, and checked by scientists from the universities of California and Pennsylvania, throw new light on this age-old problem.

From deep within an ancient Mexican pyramid, from an old California mission, and from a hundred other ancient structures, Dr. Bartle has gathered material which gives



(Continued to page 140A)

San Luis Obispo

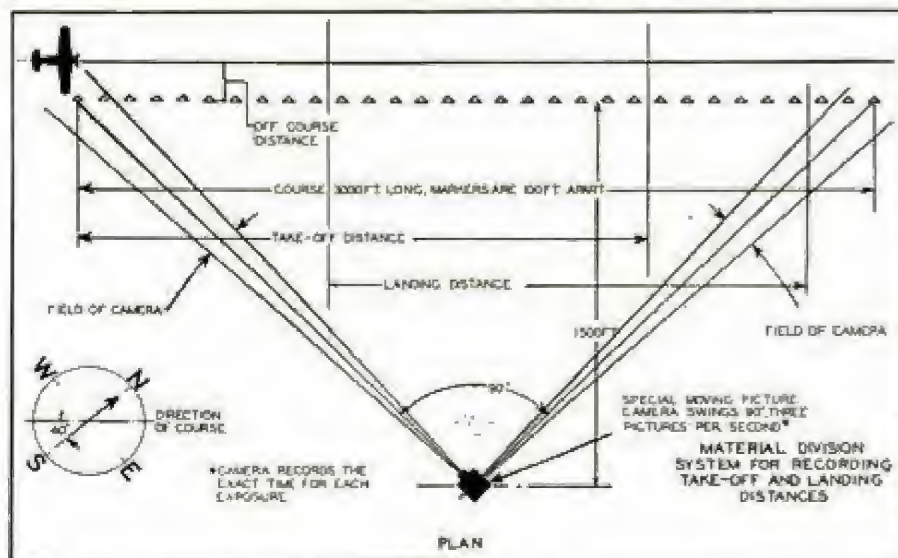
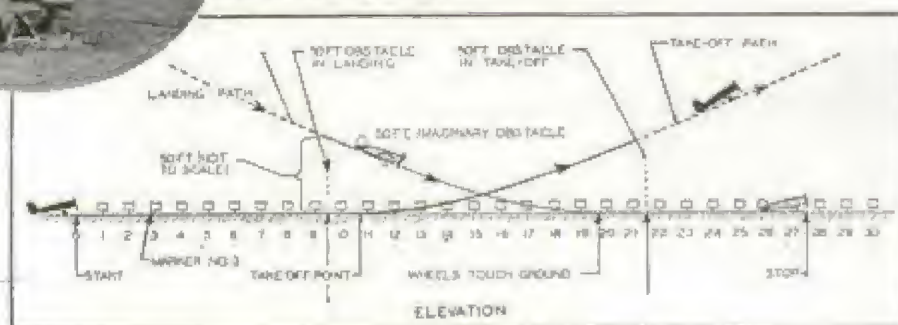
Movies Help Test Plane on Marked Runway



taken beginning just before the actual takeoff and ending when the plane has risen over fifty feet. Landings are recorded from approximately sixty-five feet altitude until the wheels stop. In this way the camera produces charts which show exactly, without need of calculation, the horizontal and vertical position of the plane relative to the markers, with the time recorded at each stage.

Left, movie camera mounted inside shack shown in circle. Below, diagrams of measured runway and arrangement of camera

MOTION pictures made with a camera built along lines of a machine gun for accurate aiming help army air corps engineers at Wright field in studying planes to be tested for landing and takeoff characteristics. The views are compared with reports of the pilot, the course observer and instrument records. Thirty large flags numbered consecutively are spaced equally along a 3,000-foot course, opposite the center of which a portable camera shack is located. At a signal from the cameraman the takeoff starts. A series of continuous shots are



Radium "Machine Gun" Bombardment Converts Platinum into Gold

Gold atoms are manufactured artificially at the laboratories of Columbia University school of engineering by placing a thin sheet of platinum in contact with a glass rod containing radium. Left inside a heavy lead container for several hours, the radi-

um shoots thousands of atomic particles into the platinum, resulting in the creation of gold. The amount of gold produced, however, is so small it can be detected only by an extremely sensitive apparatus that measures atomic radiation of gold atoms.

Prof. John R. Dunning, Dept. of Physics

Pillow Slips and 'Dry Diving' Offer Beach Fun



The inner tube of a truck tire half buried in sand forms perfect springboard for gymnastics on beach. Above, a seaside acrobat takes off for somersault

Fun on the beach isn't all wet. You don't have to go near the water! One of the current popular sports at winter beach resorts, for example, is a sort of "dry diving." You go through the motions of a dive but you land on the sand. One man runs and jumps on the high end of a teeterboard, catapulting his partner, who was on the lower end, into the air for a flip



Motorcycle polo calls for plenty of skill when navigating in sand. Players (left) use a white ball, and kick it instead of swinging mallets. Above, riding pillowcases in surf; a large case is soaked, then inflated with air by running along the beach while holding the end open like a scoop. Then turn the end quickly and tie a knot and it's ready for surf ride

AMERICA'S DINNER



Top, left, sampling interior temperature of orange after pre-cooling and icing. Right, ice blocks on way to loading platform. Bottom, blowing machine forcing crushed ice into freight car

degrees temperature had been blown into the lettuce car instead of warm ice just a degree or so below freezing. Fruits and vegetables have critical temperatures at which they keep best, and temperature control is

FROWNING over a telegram in front of him, the refrigeration chief dialed a phone number several hundred miles away.

"What's the matter down there?" he demanded. "You know that shipment needed warm ice and here you've used cold ice again. If you can't keep the ice warm we're going to lose a lot of vegetables."

His speech sounded like nonsense but he meant every word of it. His complaint was that a carload of lettuce had been frostbitten on the way to Chicago because its ice was too cold. Ice takes on the temperature of the room in which it is stored, and in this case chopped ice of around ten

one of the important factors to be considered in shipping perishables.

Supplying America's dinner table with out-of-season fruits and vegetables accounts for an important part of the nation's rail traffic. Lettuce, carrots and celery may be out of season but the chances are you can buy them at the nearest grocery. Instead of depending on its local gardens, modern America reaches out to all parts of the country for its fresh foodstuffs. Items that are in season locally for only a few weeks now can be bought for months on end. Some fresh vegetables are available practically the whole year around.

RIDES *the* RAILS



Behind these everyday facts is a complicated organization that uses short-wave radio and leased telegraph communication and an intricate refrigerated transportation system. The north is supplied with early vegetables grown in the south and the south is sup-



Top, left, mechanical loader at work. Right, air-conditioning tubes blow cold air into one end of car and exhaust warm air from other end. Bottom, heavy locomotive hauling fast food express





tables to meet the demands of the refrigerated market. Good shipping qualities as well as uniformity and solidity in a variety bring best prices.

In Chicago, home-grown lettuce is scarce even at local harvest time but you can buy California lettuce every month of the year in that city. Local cantaloupes come on the Chicago market in August yet the city begins to eat the fruit as early as May, when the first California shipments

arrive. In June, Arizona and Georgia also ship cantaloupes to the northern markets and in July, Texas, New Mexico and Indiana also join the shipping states. Nine states ship cantaloupes to Chicago in August and the melons are still available from California, Colorado and Utah during September.

Potatoes are the nation's largest vegetable crop and nearly a quarter of a million carloads are shipped annually. Maine is an important source of potatoes, yet early in the season before their own potatoes are ready the Maine farmers eat potatoes that have been shipped from the Pacific coast. Mas-

(Continued to page 130A)



plied with northern vegetables long after its own growing season is over. To a large extent the east lives on what the west raises.

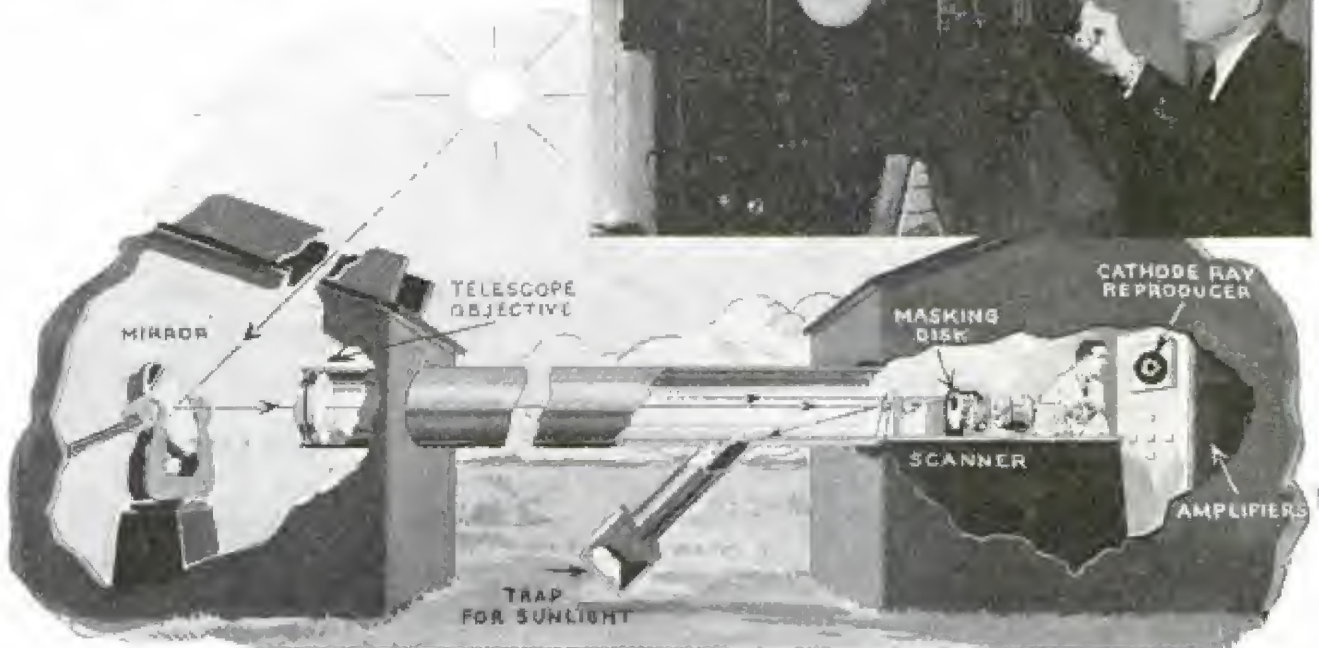
One result is that the eating habits of the nation are undergoing a change. Salads have become an important part of the national diet now that they are nearly always available. Another result is that growers have developed special varieties of many vege-



Top, cab-in-front engine used for hauling refrigerated cars over mountains. Center, crew member operating pipe that packs snow ice under pressure into all empty spaces of carload of lettuce. Bottom, air-conditioning equipment used for removing field heat from vegetables before the car is iced

Sun's Corona Poses for a Television Picture

Secrets of the sun are learned from its corona, but that flaming halo only can be studied during solar eclipses because of the brilliance of the sun's orb and the scattering of light in the earth's atmosphere. Now television has suggested a way to put the corona under inspection at



Top, the cathode-ray tube receiver on which sun's corona can be watched "in action." Below, a diagram of arrangement of mirrors and masking disk which dissipate direct image of sun and reproduce its corona

all hours, which radio men will appreciate, for disturbances in long-distance radio transmission start in the sun and it may be possible to predict transmission troubles from day to day by keeping an eye on the sun. Dr. A. M. Skellett of the Bell Telephone Laboratories devised the television system for scanning a ring around the sun. A horizontal telescope focuses a sharp image of the sun on a mirror, and this bright image is reflected away and

dissipated in a trap. Around the sun's image is the corona, and this is scanned by a combination lens and mirror which rotates and rocks, throwing light from the corona into a photoelectric cell where a current of varying magnitude is set up. The steady current due to light from the sky is discarded in the amplifying system and the coronal light is routed to a cathode-ray tube of a television receiver, where the corona may be viewed or photographed.

Slide Fastener on Cleaner Bag Opens to Remove Dirt

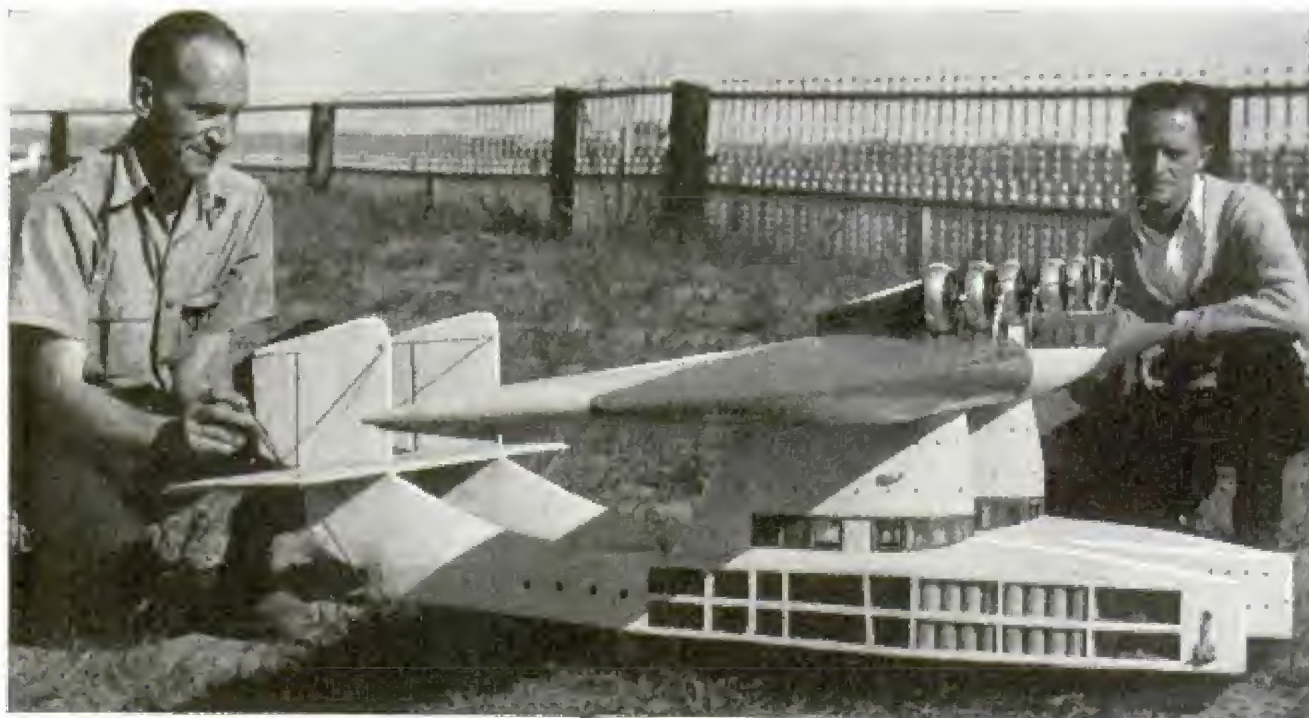
Fitting virtually all vacuum cleaners with one attachment and needing no special couplings or adapters, a bag now on the market relieves the housewife of some of the work involved in emptying it. Instead of disconnecting the bag to unload it, you simply drop it to floor level by releasing a tap which holds the bag upright. A slide fastener then is opened which permits accumulated dirt to drop out.



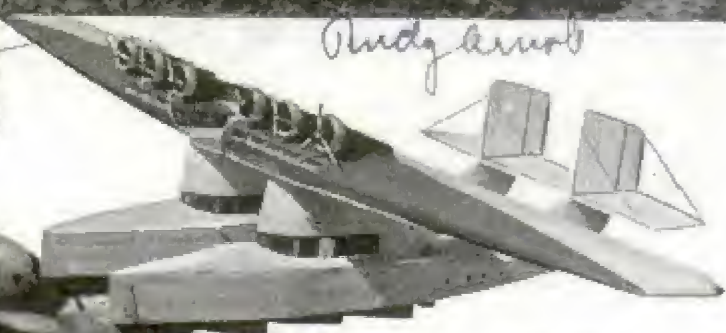
Slide fastener opens vacuum cleaner bag to empty it

Chicago Loblatt Bros.
35-37 E. 20th St. Chicago
Slide-A-Bag Corp.

Super-Liner Designed to Fly 500 over Atlantic

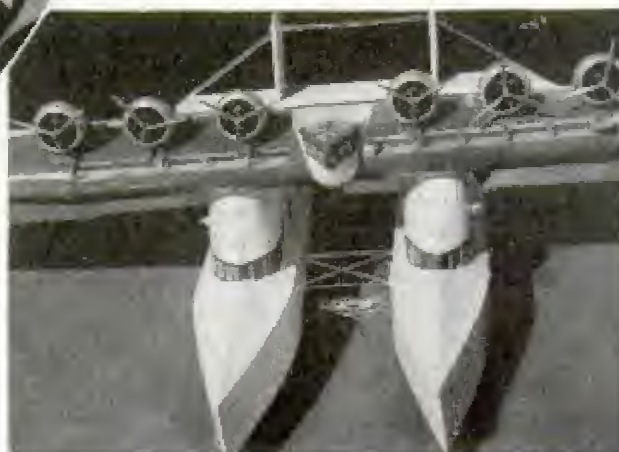


Inventor John Malinet (above, left) of Rosedale, L. I., with model of 500-passenger transatlantic air liner which would be powered by six electric engines served by dynamo generators burning fifty gallons of fuel oil per hour



Fins seen underneath the pontoons, above, are to protect the hulls from shock upon hitting the water, and also hold the plane on a straight course on the surface. The great ship would have an air speed of 200 miles per hour; on the water it would be driven by propellers underneath the hulls, with electric motors capable of developing a top speed of thirty knots. Notice the glassed-in promenade for passengers just below the engines. Besides its capacity for 500 passengers, the super-liner would devote the entire bottom section to freight cargo, as indicated in top picture

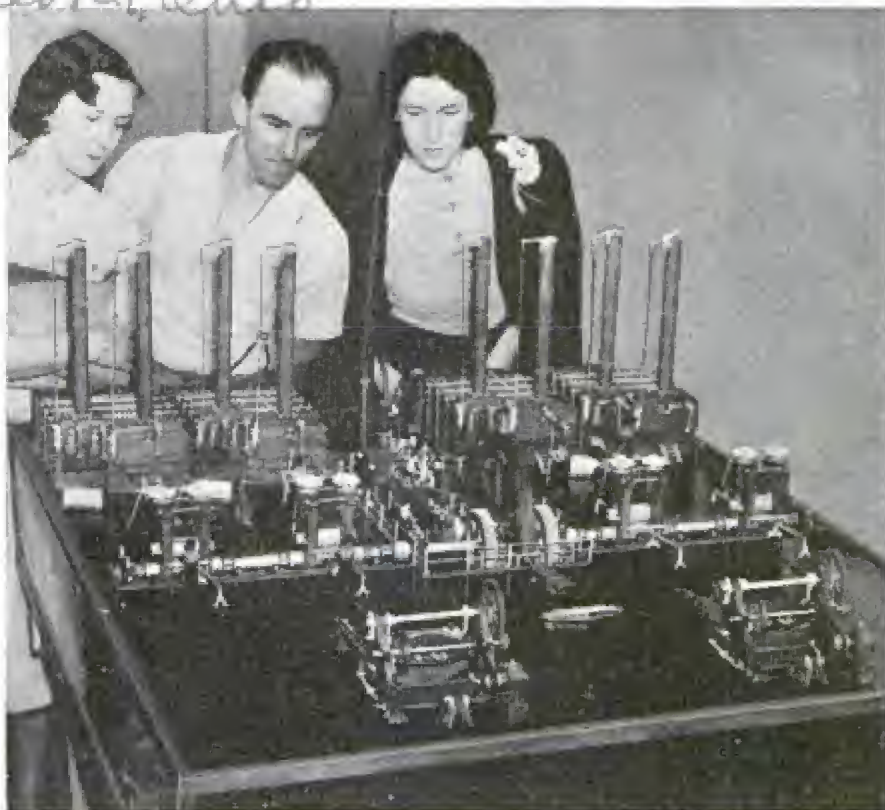
Above, the inventor explains his model to Coast Guard men at Floyd Bennett field. At the right is a close-up front view showing the huge twin pontoons and the three control cabins. Present plans would put the air crew in the central cockpit on the leading edge of the wing, between the engines. Navigators would be located in the right pontoon, and another crew charged with running the plane when it is on the ocean would have its post in the left pontoon



136-21-24344

Model Steel Mill Carved from Wood and Ivory

Twenty years ago Ernest Warther worked in a steel mill. Not long ago he decided to build an animated model of the mill—and, since the plant has not been in operation for fifteen years, he had to build it from memory. There were no blueprints. The task required five months. Carved from walnut, ebony and ivory, peopled by a tiny crew of engineers and workmen at their various tasks, the miniature mill is a faithful copy of the plant as it was a score of years ago. A small electric motor concealed beneath the base of the four-by-five-foot model keeps the wheels running.



Built from memory long after original plant closed, this model steel mill carved in wood and ivory goes through the motions of steel-making

Linemen Use 'Hot Stick' Tools for Repairing Live Wires

Maintaining and repairing "hot" lines of high-tension electricity without pulling the switches are the daily chores of linemen. This is possible with the use of ingenious "hot sticks," which consist of

rounded lengths of Sitka spruce equipped with various metal attachments including clamps, pliers and other tools. With a set of about ten of them a skilled operator can perform any line work on a pole or tower



Left, "hot sticks" hold high-tension wires at safe distance while men work on pole. Right, lineman handling "hot" wire with extension tool

which can be done by hand, from changing insulators that weigh as much as 200 pounds to replacing an inch cotter pin, without interrupting service. Workers are careful to keep at least two feet from the lines, because of a field of electricity known as a corona which extends as far as twenty inches around the high-voltage wires. Coming within its range can be disastrous. The men wear rubber suits and head gear for protection against flashes of flame that may occur while throwing big switches.

A.B. Chance Co., Centerville, Ind



Circle, census taker at work. Center, semi-automatic population punching machine. Right, electric tabulator which helps to compile the millions of facts gathered in the census. Statistics are fed to the machine in the form of cards on which holes have been punched according to a code

Opposite page—Top, left, old tabulator (at left) and the new portable tabulator. Right, electric gang puncher that records the same facts on a large number of cards. Circle, verifying machine double-checks on population punching machine. Bottom, machine that sorts cards into different classifications

COUNTING



CENSUS experts in Washington, facing the largest population count in the history of the United States, have developed for this year's census a revolutionary technique to meet the numerous problems that have arisen since 1930. A two-weeks test of the new procedure, completed recently in St. Joseph and Marshall counties, Indiana, was so successful it will serve as a model for the head count throughout the country.

The newest problem faced—and tackled—in the Indiana test was that of the person who lives in a trailer. Little is known about the number of persons who call trailers their only home, except that there are a great many of them and that since 1930 they have increased a thousandfold, with 1933, 1934 and 1935 as peak years.

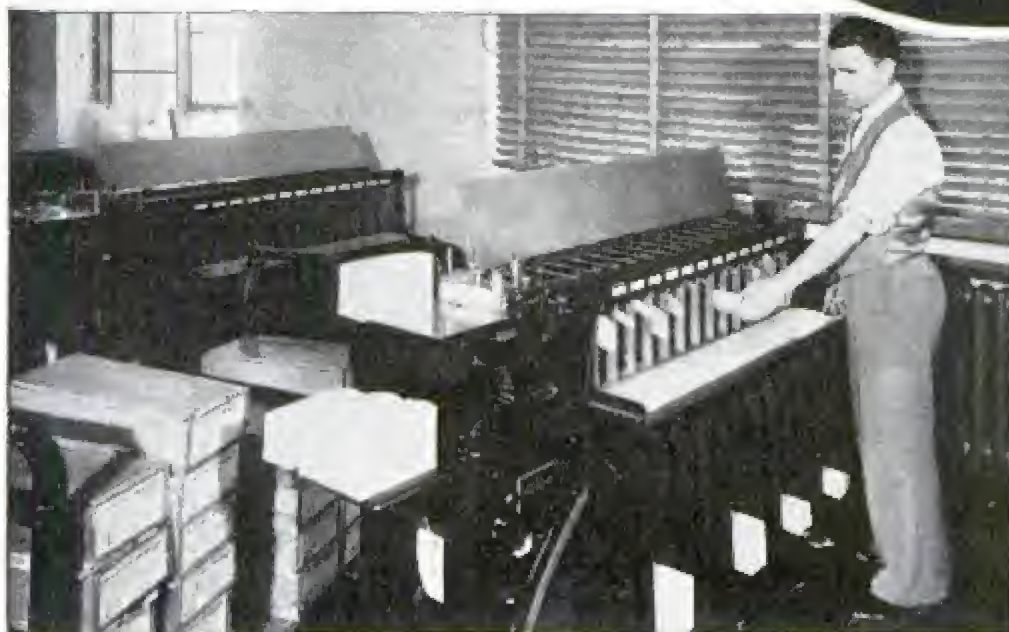
Another new problem was that of ascertaining the effect of the Social Security Act on the nation and the laws of such agencies as the FHA, the HOLC and the USHA. The Social Security Act and these agencies have come into being since 1930. Two questions,

2 108.6



NOSES

therefore, have been found pertinent to their administration for the 1940 census. They are: "Does this person have a Social Security account number?" and, "What proportion of this person's wages or salary was subject to deductions for federal old-age insurance during the twelve months ending July 31, 1939?"



These questions will help the Social Security board in establishing its records for the huge task of administering the old-age insurance and unemployment compensation benefits program. In the case of the FHA, HOLC and USHA laws, questions were asked to bring out the type of home in which the present-day American lives and

(Continued to page 114A)

Swamp Car Pulls Self through Mud by Winch



Left, marsh truck of United States Indian service can navigate water two and one-half feet deep and makes its way through mud and swamps far into Everglades of Florida to reach Seminole reservation. Below, view of winch for pulling out of tough spots, and bars guarding radiator



Able literally to pull itself through swamps and water, a truck has been designed for the use of United States Indian service in traveling between civilization and a Seminole reservation set deep in the Everglades of Florida. The swamp car has a power winch mounted in front on an eight-inch channel-iron crossbar, which receives power through a take-off on the transmission. Vital parts of the motor and the crankcase are sealed against water, and the truck can travel through two and one-half feet of water. Mud-grip tires at the rear provide traction, and iron bars guard the radiator and headlamps.

Picture Is "Painted" with Wood from All Parts of World



Pictures made with inlaid wood of many colors

Wood from all parts of the world is used by one artist instead of paint in creating pictures. Cut into tiny pieces, the wood is assembled and inlaid with such expertness that the pictures appear to be paintings. Having learned the art in Austria-Hungary before the World War, the "painter" now works at it as a hobby.

Live Fish Shipped in Dried Mud "Barks" When Released

Surviving a 10,000-mile journey that started at Lake Nairobi in central Africa and ended in Chicago, a lungfish "barked"

I m. thought G. Prardin
c/o Seminole Indian Reservation
Brighton, Florida

John Paulin, Cleveland
3909 Truax Ave
Cleveland, Ohio

John Paulin
3909 Truax Ave
Cleveland, Ohio

Scene Service
Nov. 6.

lustily when it was released from its "nest" of dried mud. At the start of the trip, the fish was put into a can containing soft mud, which was permitted to dry out slowly. While the mud remained soft, the fish came to the surface at intervals to fill its lung. Finally it settled to the bottom and secreted its cocoon, obtaining the small amount of air it needed through the channel formed by its risings to the surface. On arrival at destination, the fish was found in the cellulose-like cocoon. Waking from its dormant state, it made barking sounds by exploding air from its lung. Although thin from its long fast, it was in apparent good health. Lung-fishes, explains Dr. Homer W. Smith of the New York university college of medicine, are evolutionary leftovers from the Devonian geologic period, about fifty million years ago, when all of the higher-class fishes breathed air with lungs.

Loud Speaker on a Sidecar Aids in Direction of Traffic



Durban policeman using loud speaker mounted on his sidecar for directing vehicles and pedestrians, while his comrade drives the motorcycle

Motorcycle police of Durban in South Africa are using a sidecar loud speaker for directing traffic and promoting safety. The vehicle carries two officers, one to drive, the other to operate the loud speaker.

Flash Bulb the Size of a Peanut Has Quick-Change Base

Only a little larger than a peanut, the newest flash bulb for photographers is



The peanut is there to show you how tiny is this newest flash bulb, which produces a brilliant light

nicknamed the "mighty midget" because of its powerful light packed in a small space. It is wire-filled, and has a bayonet-type base like an automobile lamp to permit rapid-fire loading in reflectors. Designed for all except focal-plane shutter cameras, the bulb produces nearly a million lumens at its peak. The bulb is protected both inside and outside with a lacquer safety jacket.

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9952. *Emt Thomas E. O. Thomas Jr*
18618 Malibu Road
Pacific Palisades, Calif

Making BETTER HOME



Above, filming an actor against a projected background, and shooting scene with the help of a painted-glass screen. Left, editing film with a small viewer that enlarges each frame separately. Below, amateurs obtain best results by mounting cameras on tripods



Photo from Bell & Howell Co.

DURING the last few years amateur movie photography has grown from a hit-or-miss recording of family scenes to a craftsmanship that sometimes rivals the work of Hollywood cameramen.

Scores of amateur clubs are writing their own scenarios and producing exciting mystery and adventure films. The clubs hold motion-picture parties at which dramas and sport shorts, filmed by members, are shown. Occasionally capable amateurs have been able to turn their hobby into money and have sold their pictures for hundreds or thousands of dollars.

Today movie fans are shooting many of

their scenes in color. Some are experimenting with sound accompaniments that they record themselves. They are duplicating nearly all the special effects achieved by the big studios.

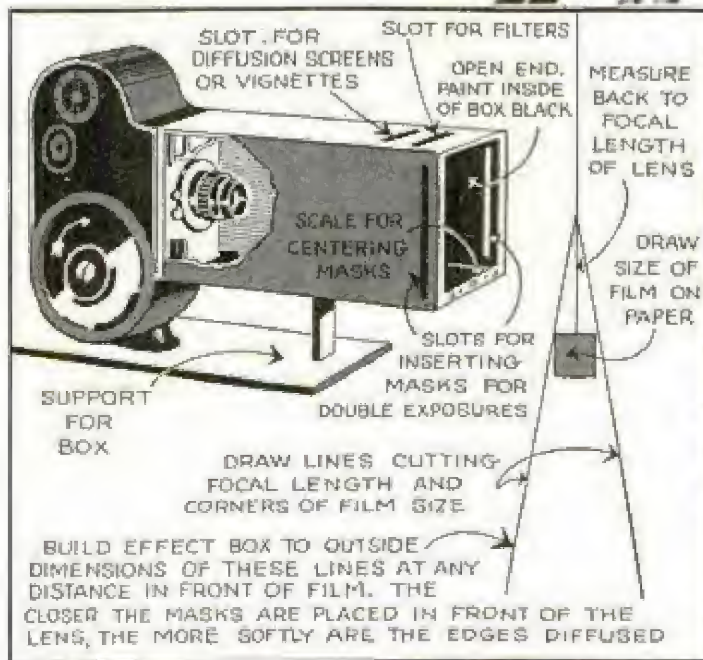
The reason for this rapid growth, says Lewis W. Physioc, instructor of cinema-

1117 North McCadden 1851 W. Karcher

2952

MOVIES

tography at the University of Southern California, is that the hobby has become much less expensive than at first. New small cameras on the market sell as low as ten dollars. In the medium-price field are cameras that are precision instruments adaptable to nearly every demand. Sixteen-millimeter cameras use film only one-fifth the size of professional film and the baby of the art, the eight-millimeter camera that you can hide in your hand, uses film only a quarter the size of the sixteen. The new "eights" project clear pictures that fill a four-foot screen, and even greater enlargements are satisfactory when the film is slightly overexposed to reduce objectionable grain. Black-and-white film for an eight costs two dollars



Top, an amateur photographer signals actors to start scene after preparing small movie camera for sequence. Below, at left, diagram showing how to make and install "effect box." At right, an effect box made of an old camera bellows



diagonally across the film so that as many as twenty-four frames on each side of the splice are partly covered. Trim the tape away from the film perforation track. Using the wipe cuts part of one scene away while part of the new scene begins to appear."

One of the simplest and most effective tricks is to make things appear or disappear in a picture. You can film a friend reaching to pluck a candle out of thin air to light his cigaret. Stop the camera when he extends his hand, place the lighted candle in his hand, and resume filming. He shouldn't move his hand while the camera is stopped. Books or other objects can be made to appear or disappear merely by stopping the camera and placing



or less for a four-minute length, and color film costs a little less than twice as much. Professional processing into a positive print for projection is included in the price of the film. With photoflood lights, any room becomes a studio.

"Clever titles, wipes and dissolve shots to separate scenes, and trick photography in your films make them much more interesting to your audiences," Mr. Physioc says. "Scenes may be faded in by starting the camera with the lens closed. Then slowly open the lens to the correct aperture. Fade out the scenes by closing the lens while the camera is still operating.

"If you wish, use an artificial wipe between scenes. This is done while editing the finished positive. Splice the two scenes in the usual manner and fasten a thin piece of opaque Scotch cellulose tape

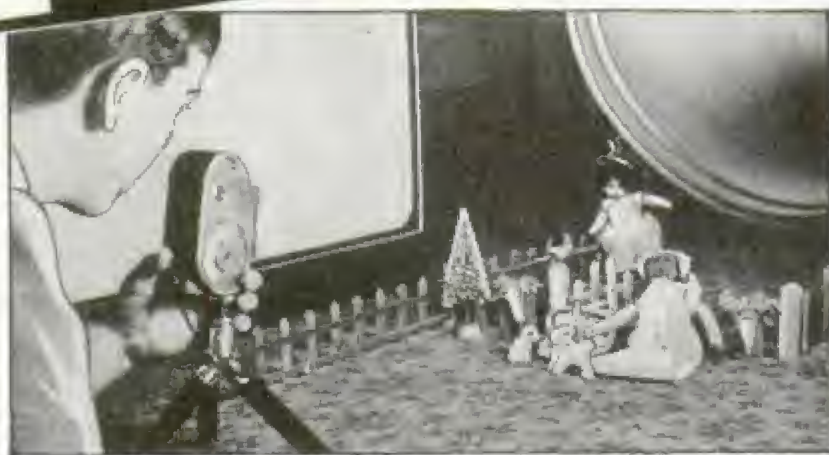


Photo from Bell & Howell Co.

Eight-millimeter movie camera mounted on title-making stand, top. Center, masks for framing pictures in effect box. Below, table-top scenes can be animated by single-frame exposures

them in position or removing them; in the same way you can make an actor appear to pull loaves of bread from a friend's pocket.

Judiciously used, scenes that are recorded backward are an interesting part of a picture. If your camera hasn't a reverse on it, film the scene with the camera upside down and turn the processed film end for end in projection. With the eight

(Continued to page 116A)

Navy Scouts the Ocean Sky with Fast Seaplane



Built primarily for surveillance work by navy fliers, this seaplane also can be adapted for flight over land by installing wheeled gear instead of the triple pontoons. It is a high-speed observation ship

"Eyes of the fleet" are the observation planes sent up from battleships and cruisers to patrol the skies. The U. S. Navy has

just acquired a new "eye," a fast scout-observation seaplane. It is a single-motored ship with triple pontoons.

Road Sign Shows Car's Speed as Auto Nears Danger

Automobiles turn on the lights of an automatic highway sign which will be placed at curves, hill crests and dangerous intersections to warn drivers and reduce accidents. Besides giving notice of hazards ahead, the sign contains a speedometer that informs the motorist, "you are going over" thirty, forty, fifty or sixty miles an hour, as the case may be. The mechanism is operated by impulses received from magnetic detectors placed in the pavement forty feet apart, and over which the cars pass. The first detector acts to illuminate the sign's wording, while speed of the vehicle is indicated by an impulse from the second detector.

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Above, close-up view of sign with speed indicator. Position of magnets in road is shown below

91260 Curtis Wright Corp. 30 Rockefeller Plaza, New York

Del: Clyde A. May, 136 E. Canal, Minn.

Flashlight Storage Battery Recharged at Little Cost



Held in hand is storage battery for flashlight that can be recharged by house current or auto battery

Reduction in flashlight expense is claimed for a tiny storage battery that fits standard flashlight cases using two one and one-quarter inch size D dry cells. A cleverly designed chamber and vent arrangement, together with semi-fixation of the electrolyte, combine to make the cell spill-proof. Only simple attention is needed and its transparent Lucite case makes it easy to see when distilled water should be added. Two charging units are available, one working on regular a.c. house current, and the other on the car battery.

Giant Merry-Go-Round Tests Mines and Bridges

Models of mine workings and of bridges, built to scale, are placed in a whirling merry-go-round at Columbia University's school of engineering in order to determine how safe they will be. These models, made of transparent Bakelite plastic, are spun in a giant centrifuge, and the stress built up by the centrifugal force—reaching 2,000 times that of gravity—substitutes for the stress that might be encountered in real mines and bridges under actual working conditions. In the case of mines, engineers learn just how far they can safely drill and at what point the pressure from above would smash the mine, since the

centrifuge can be speeded up until the miniature rock collapses just as a real mine would under the force of gravity. In measuring the stress endured by whirling bridge models, polarized light from a powerful mercury arc lamp is flashed on and off rapidly. This is synchronized with the speed of the centrifuge so closely that the transparent model is seen as though it were standing still. Engineers study the light and dark bands that move through the model, and these photo-elastic fringes enable them to calculate just how and where a bridge of that same design will be stressed in actual service.

Electric Iron with Hinged Grip Presses Clothes on Wearer

Clothes can be pressed while they are worn, or on the ironing board, with an electric presser that has two pressing surfaces and a folding handle. Trousers are given sharp creases, and wrinkles are removed all the way to the seams. In like manner it presses coat sleeves, lapels, col-



Electric iron grips necktie when pressing it; inset shows iron in position for use on ironing board

lars and vests. The iron is also used for putting a crisp and fresh finish on such smaller articles as ties, gloves and handkerchiefs.

Send return postage to our Bureau of Information to learn the name of the maker of any device described in this magazine.



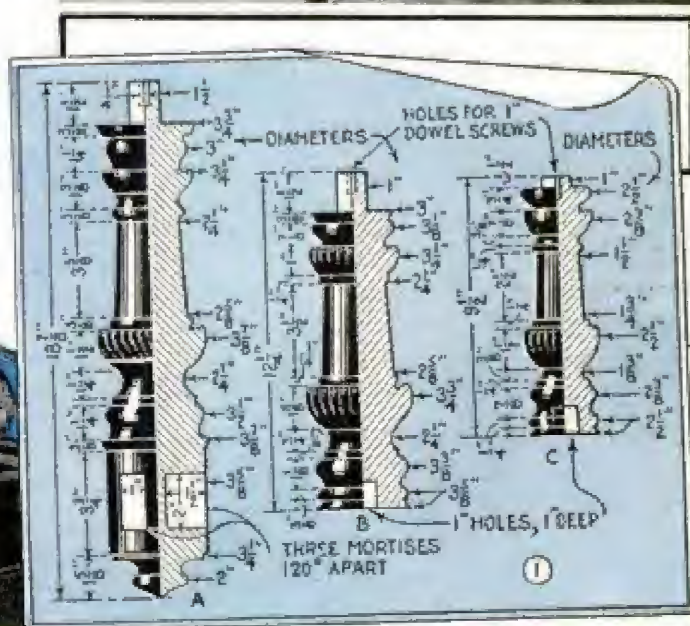
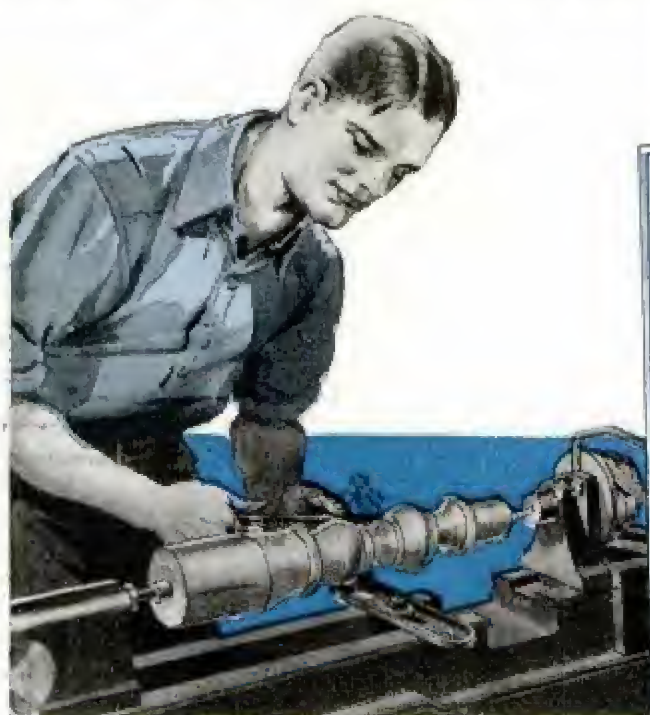
The CRAFTSMAN

Turn this graceful THREE-TIER TABLE

By HENRY E. BELDEN

COMBINING the utility of three large, round shelves in graduated diameters with the attractive features of a massive turned column and curved legs, tipped with claw-and-ball feet, this tier table fits easily into the decorative scheme of any home. It is made of solid stock throughout. Although other woods can be used, the original tier tables, of which this one is a close copy, were solid mahogany.

Starting with the three turned sections which make up into the column when assembled, you will need two 4 by 4-in. squares for the first and second sections, and one 3-in. square for the top section. See the details A, B and C in Fig. 1. Once you have these turned out to the sizes



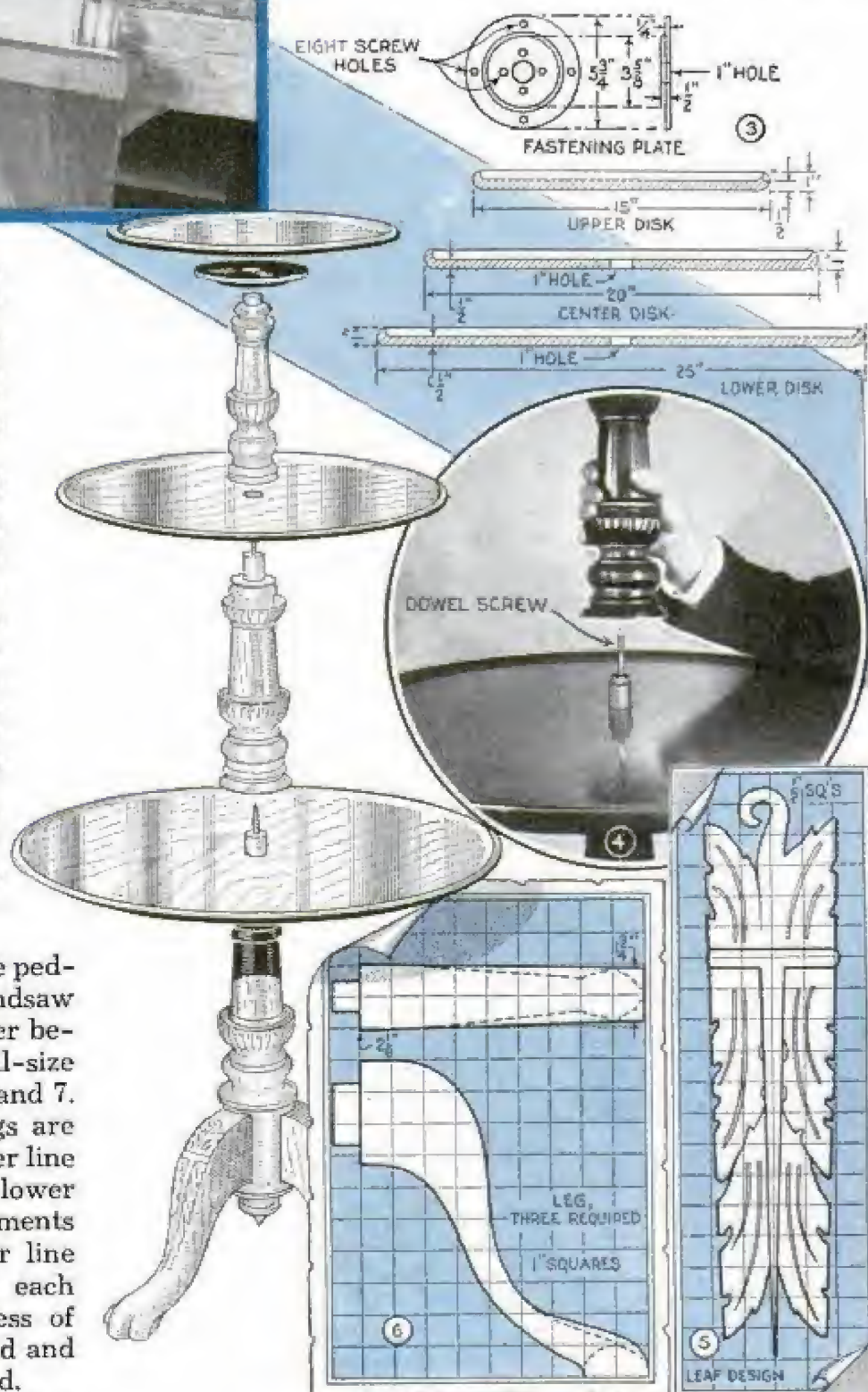


given, mortise the lower section as in Fig. 2 to take the three legs. The large undercut beads of all three sections are ornamented with hand-carved spiral reeding as indicated in Fig. 1. Use dividers to space the reeds an equal distance apart, then cut the vees with a wood carvers' V-chisel, taking care to keep the spirals uniform and the vees all the same depth. Of course, if you wish, you can simplify the work on the column considerably by omitting the reeds.

The three legs for the pedestal are cut with a bandsaw from $2\frac{1}{2}$ -in. stock, after being laid off with a full-size paper pattern, Figs. 6 and 7. After sawing, the legs are marked off with a center line on both the upper and lower edges. Equal measurements taken from this center line simplify cutting from each side to give a thickness of $2\frac{1}{8}$ in. at the upper end and $1\frac{3}{4}$ in. at the lower end.

In carving the legs the

first step is to make a full-size sketch of the leaf design, Fig. 5. Then use carbon paper as in Fig. 8 to transfer the design to the top of the legs. The carving of the leaf design is completed before starting work on the ball-and-claw feet. If you don't feel equal to carving the feet you can simply square the end of the leg and fit a ready-made brass claw foot which is equally attractive. Carving the leaf design on the



upper curve of the legs is very easy once you have the lines laid out on the wood. Careful work with a V-chisel and fine sandpaper will turn this trick very nicely. The main thing is to get the work smooth so that it takes the finish well. The legs may be fastened to the central column by mortise-and-tenon joints. The tenons were first roughed out on the circular saw and then finished up by hand. The shoulders are then fitted to the round column by paring away with hand chisels to make a tight,



neat joint. Clamping the legs to the column while the glue dries requires a bit of patience and ingenuity. If you have a couple of bar clamps you can use the waste stock which was cut away when you sawed out the legs. This will be curved just right for clamping blocks. Fit the tenons carefully in the mortises and only moderate pressure will be required to hold the legs in position until the glue dries. With the legs glued to the first section of the column you can set this assembly aside until the shelves or trays have been finished. These are made by gluing together a number of strips of $1\frac{1}{8}$ -in. stock to form a square large enough to bandsaw into a circular disk of the required diameter for turning. Note that the lower tray, Fig. 3, is 25 in. in diameter. This means that the rough disk should measure at least $25\frac{1}{2}$ in. to allow for turning. Using an improvised floor rest



for the tool, you can turn these disks by mounting them on the outer end of the lathe. If your lathe lacks this provision for handling large-diameter stock, you can easily make a special faceplate lathe for turning disks of this size. To do a good job of turning large disks where the work must run at slower speed, you have to have sharp tools. Once the disk is turned and recessed it must be sanded thoroughly. Where the tool crosses the grain there likely will be a rather rough surface. This should be smoothed up carefully by sanding, otherwise you will have trouble with the finish. Fig. 4 and the assembly view at the left show how to set up the table. Don't turn the column section too tight over the dowel screws or you may pull the threads. Use a few drops of glue on the tenons and twist the sections together by hand. Secure the top tray to the fastening plate with screws. To finish, apply either a red or brown mahogany stain, wiping quickly with a cloth to high-light the wood, then when dry, apply shellac or shellac substitute and wax.

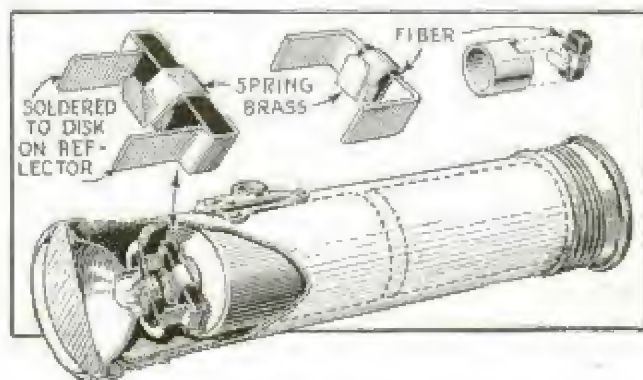
Pivoted Block Holds Wood Saw While Sharpening It



As saws used to cut stove wood are usually filed on the mandrel, some means of locking them to prevent turning must be provided. An easy way to do this is to pivot a block to the frame so that it can be swung around to engage the teeth. The end of the block should be beveled so that it will slip between them.

"Shock Absorber" in Flashlight Protects Bulb from Jars

After having the base of my flashlight bulb shattered when the case was dropped, I rigged up a shock absorber to insert be-

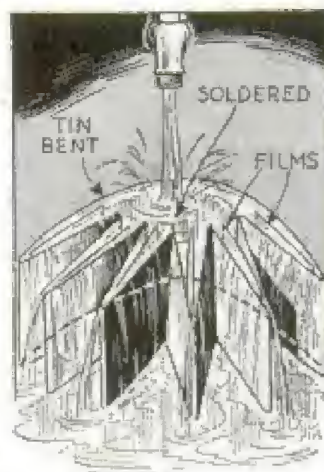


tween the bulb and cells. Either one of the three types shown can be used, depending on the type of flashlight. The spring-brass tongue, which rests against the base of the bulb, absorbs the shock. The tongue must be insulated from the frame that supports it, which is done with Bakelite or fiber as indicated in the detail.

—W. G. Reinhardt, San Francisco, Calif.

Bent Tin Makes Splashless Pan to Wash Photo Films

To avoid splashing water when washing prints or films in a sink, one photographer designed this "pan." It is merely a strip of tin bent and soldered as indicated. Also, it prevents the films or prints from floating away, keeping them separated so that the flow of water gives each a thorough cleaning.



Two Cans Assembled with Clamp Provide Gluepot



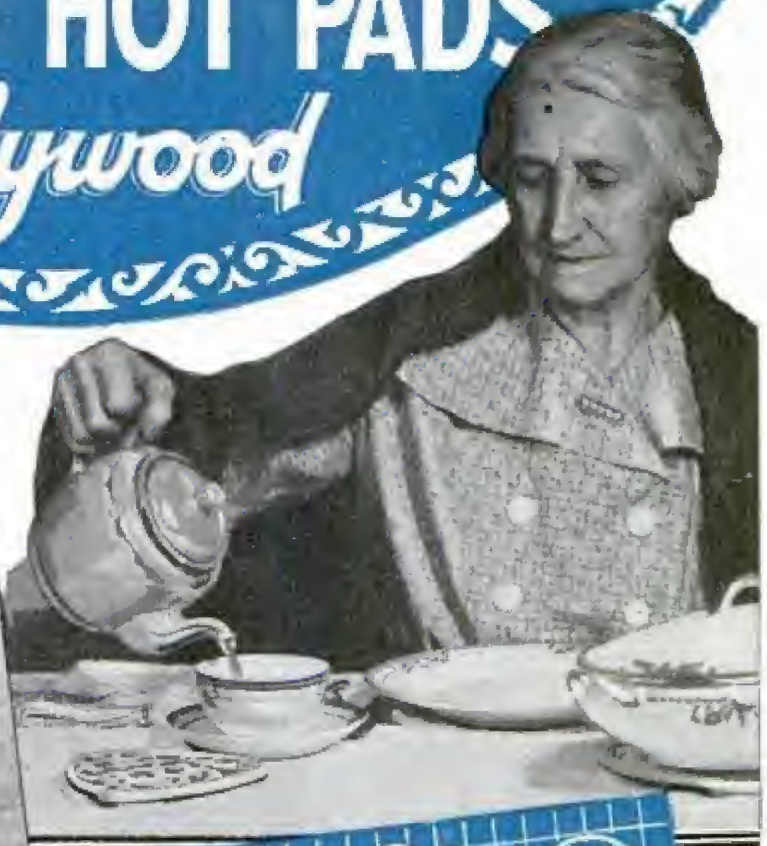
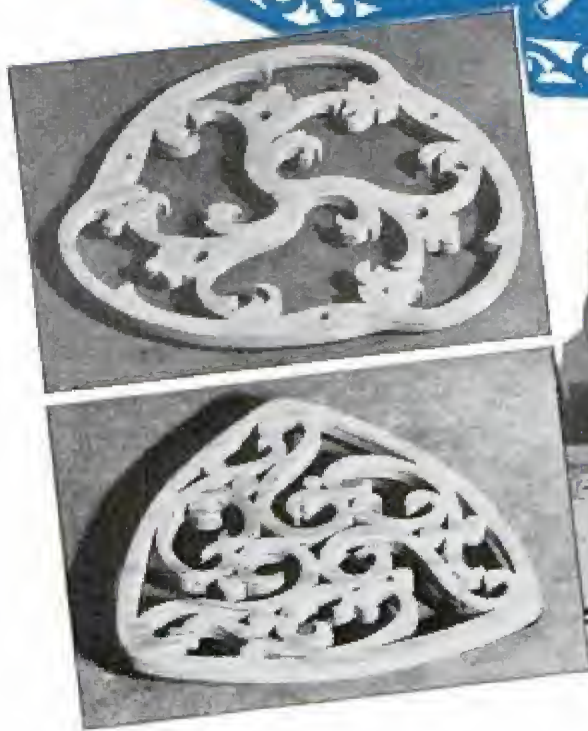
If a gluepot is not at hand, one can be improvised from two empty tin cans. Use a small one for the glue and a larger one to hold water, and clamp them together as shown. The large can should hold

enough water to keep the glue hot for some time as it is not always possible to have the source of heat close to the work.

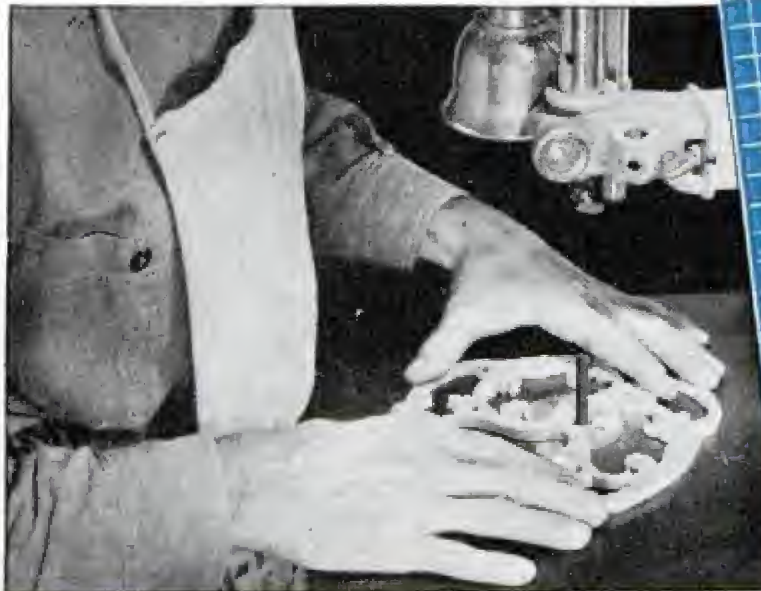
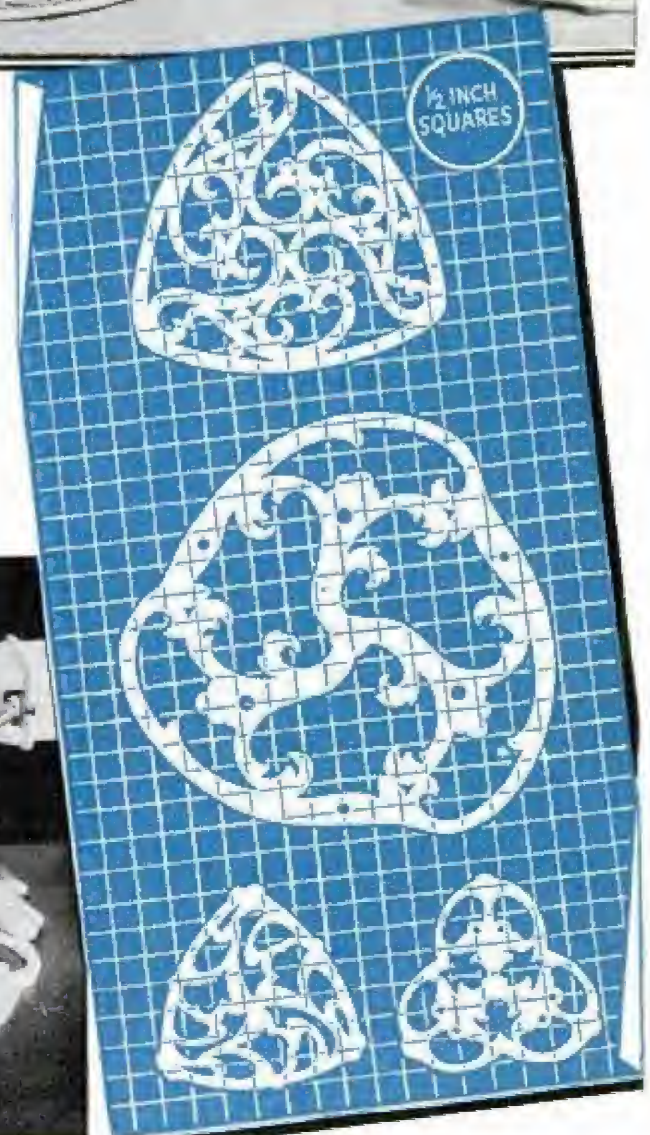
—Edmund C. Villars, S. Elgin, Ill.

☞ When selecting wallpaper, remember that large patterns and dark colors make the room appear smaller, while striped or plain paper, if light in color, will give an impression of increased size.

SCROLLED HOT PADS of Plywood



More than a century ago wrought-iron trivets, hot pads to us, were household utensils in everyday use at the pioneer fireplace. Here they are once again in the old patterns and pierced designs, but made of plywood and modernized with colorful heat-resisting lacquers or enamels. Trace the pattern full size on squared paper, then transfer the lines to the wood with carbon paper. Use $\frac{1}{4}$ or $\frac{3}{8}$ -in. plywood and cut away the waste to the pattern lines with a scroll saw. Legs are the small screw-type brass knobs. Finish in color or leave the pads plain as you desire.



The
living
room

Furnishing the



By LOWELL R. BROWNE

AS THIS doll-house furniture is simple and sturdy, it will stand some pretty rough handling by children. Fig. 1 shows the doll's living room furnished with an overstuffed davenport and easy chair, a piano, a Governor Winthrop type of desk and other suitable pieces. Size and construction of these pieces are given in Fig. 2. The davenport and the easy chair are made up of blocks assembled with brads and casein glue. Before assembling the pieces, the sharp corners are rounded off, the upholstery is put on and the feet are screwed in place. The latter are button molds. Cloth or imitation leather used for upholstering is merely glued onto the wood before the feet are attached. Seams on the edges are covered with upholstery tape also glued in place. No tacks are required. When cutting the cushion blocks, be sure that they are small enough so that after the upholstery has been applied, they will

fit on the seat. The base, pedestal and top of the round-top coffee table are assembled with casein glue on the raw wood before staining. The tiny feet on this piece are small whittled knobs.

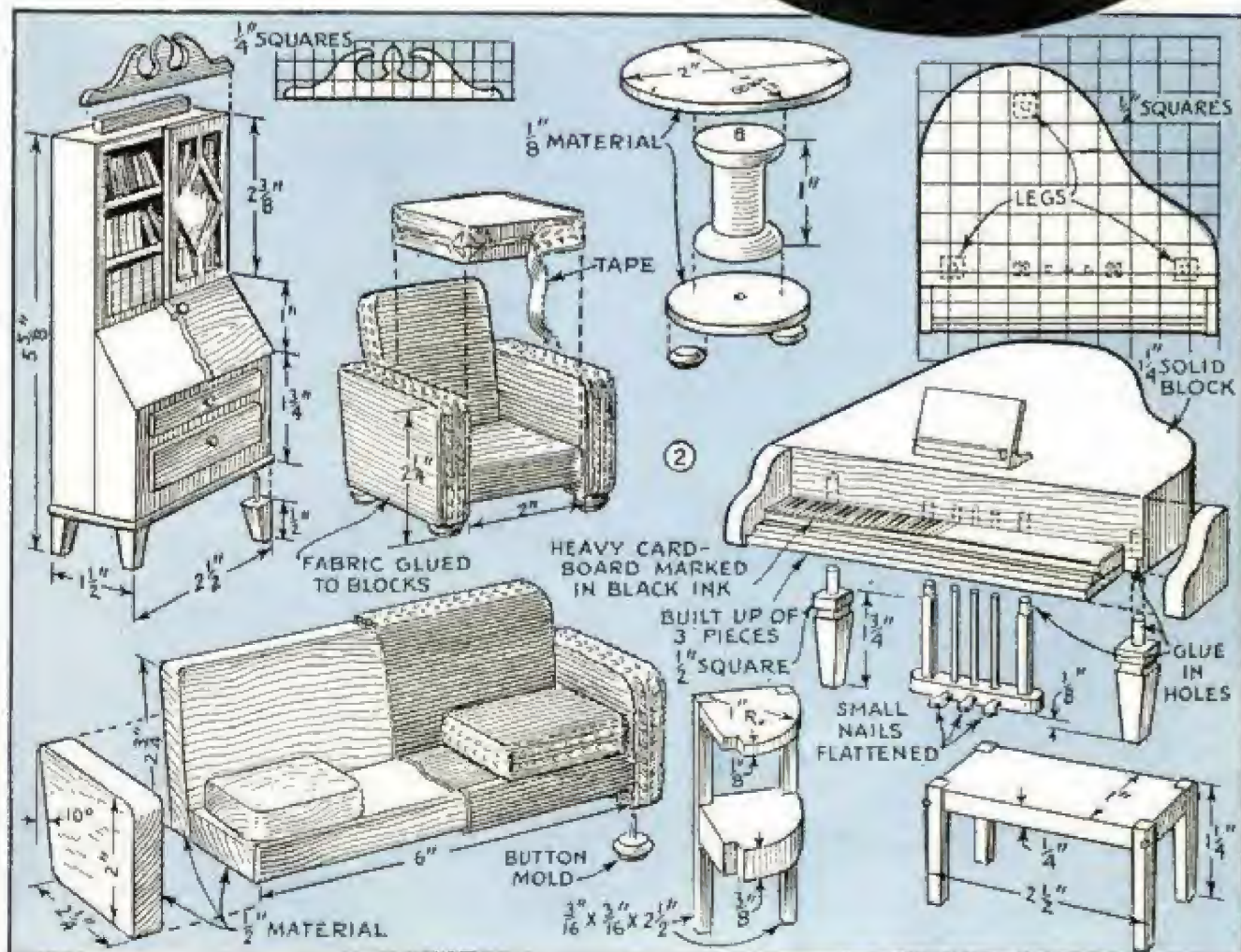
The Governor Winthrop desk is made up of two blocks glued together. A piece of bristol board upon which rows of books have been painted or drawn gives a striking effect if covered with celluloid or Cellophane to represent glass. Then scroll-sawed doors are applied. Tapered legs are fastened with glue and brads and the drawer fronts are dummies, the knobs being brass escutcheon pins with the heads pounded square. A strip of wood molding around the base completes the job. It is finished in a mahogany stain and waxed.

A simple corner table, also included in Fig. 2, can be placed in a corner of the room, or two of them set on each side of the davenport. Corners are rabbeted for

DOLL HOUSE

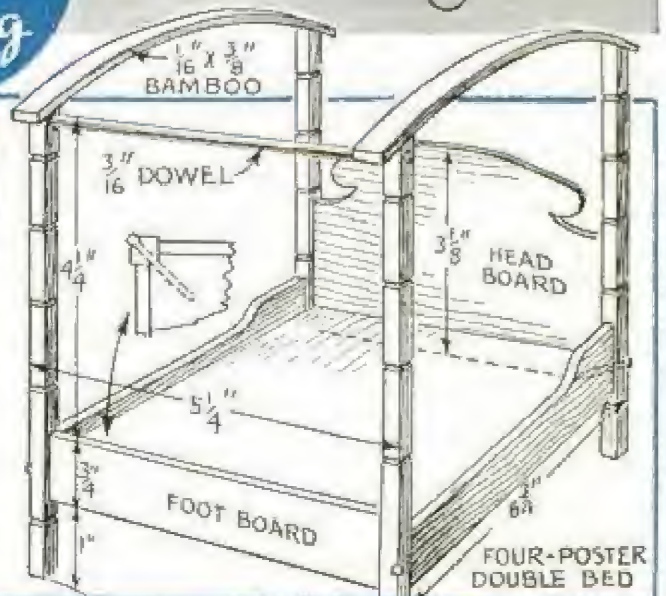
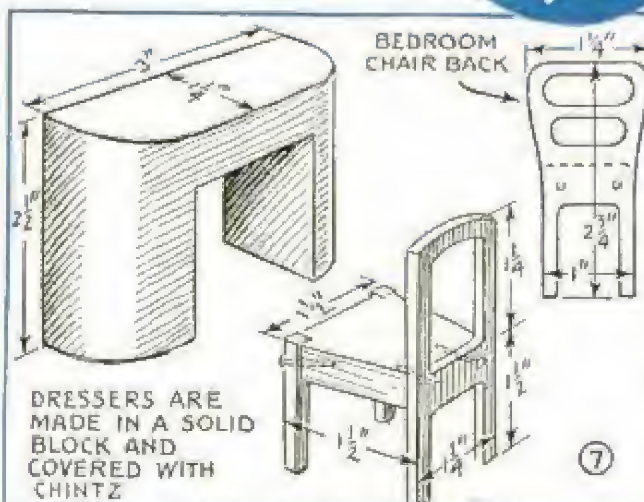
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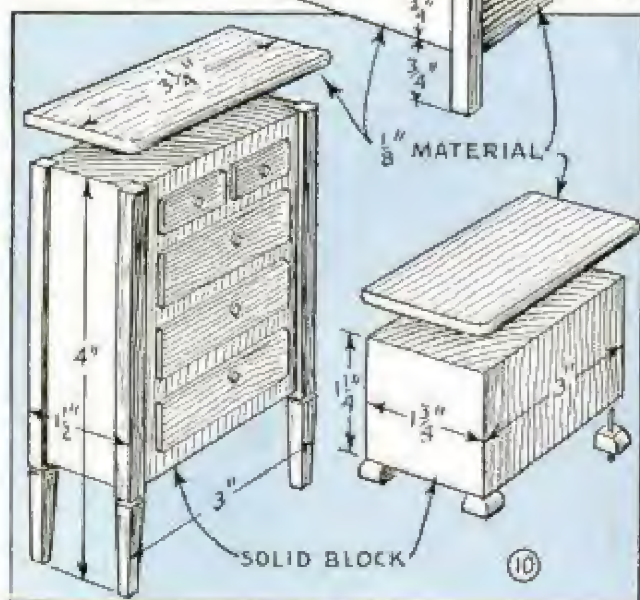
legs, which are glued in place. It is a good plan to make the rabbets in the square pieces first and then cut the curve. One of the easiest pieces to make is the grand piano. The box is scroll-sawed from a single block of wood and the keyboard is built up, the keys being marked on bristol board with a ruling pen. The music rack is glued to the top. Legs are tapered from square stock and fitted with dowels. Pedals are merely brads pounded flat. A piano bench consists of a seat with rabbeted corners for the legs. Another good piece for the living room is the wing chair detailed in Fig. 5. Thin material is used for the sides and back, while a thicker piece forms the seat. This piece is not painted,



with molded edge. A small screw is inserted up through a hole in the top of the pedestal. In making the pedestal, the bottom is slotted while the stock is square, before turning. Legs are in three pieces: a double one extending through one slot and two single ones glued in the other slots. Each dining chair consists merely of a substantial seat to which the back and the front legs are attached with small dowels and glue, the legs being set in rabbets. The latter are tapered and grooved near the top. As thin wood is used for the backs, they can be scroll-sawed four at a time. For added strength, escutcheon pins are driven diagonally through the front legs and the edge of the seat, a pilot hole being drilled first to avoid splitting.

For one of the bedrooms a four-poster bed is especially attractive. The posts are not turned, but square stock scored with a file is used. Arched members of bamboo, which are heated and bent to shape, span the top to support the covering. See Figs. 6 and 7. Bedroom chairs having scroll-sawed backs are in two simple styles. These are made similar to the dining chairs and may be



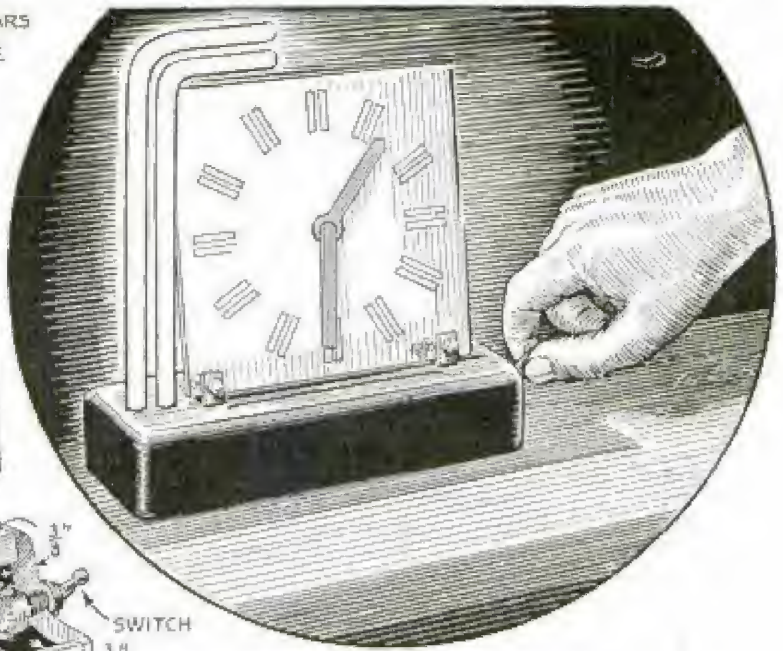
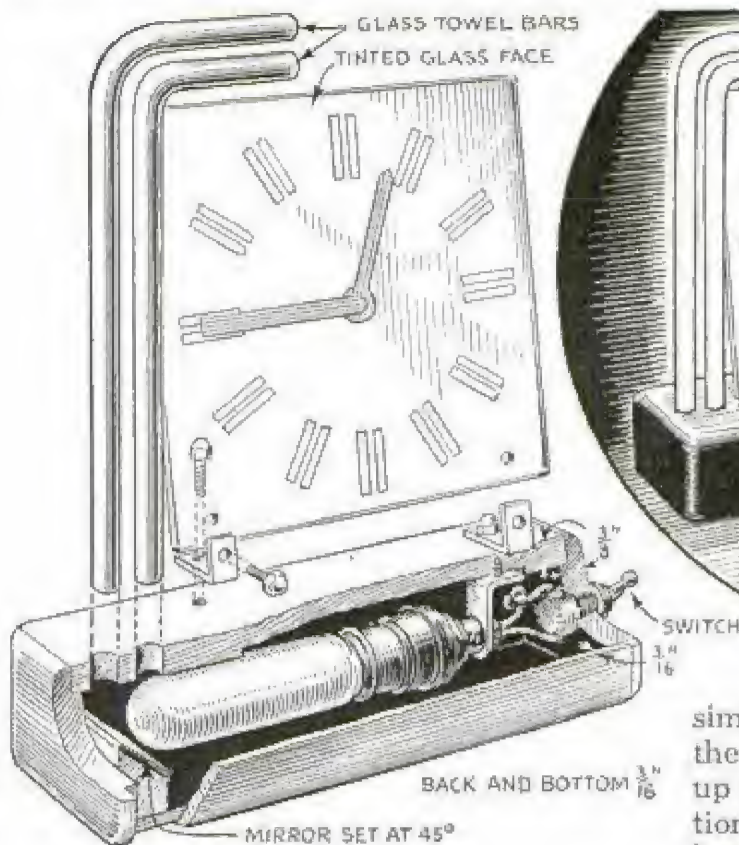


stained or painted white. A dresser is cut out of a single block of wood. The ends are rounded and then a chintz covering is provided. If a mirror is desired, one of appropriate size can be glued to a wood strip.

Double-deck beds, Figs. 8 and 9, resemble the full-size pieces, except for the actual construction of the bottoms. To assure strength, the bottoms are $\frac{1}{2}$ -in. stock, which provides ample surface to which the side members, head and foot boards are glued. The upper unit can be lifted off the lower unit if twin beds are desired. Small dowels in the top of the bed posts of the lower unit prevent the upper one from sliding off. For mattresses, pieces of $\frac{3}{8}$ -in. wood are used, these being cut to fit loosely in the bed to allow for the "ticking" which is glued on later. Other pieces for the bedrooms, such as a chest of drawers and a linen chest, are cut from blocks of wood in much the same manner as the dining-room sideboard. Assembly and sizes of these pieces are given in Fig. 10.

❏ You can test silk for color fastness against perspiration by soaking a sample of the material in diluted acetic acid for about 10 min. and then letting it dry gradually without rinsing; after a few days compare it with the original.

Glass Rods Emit Soft Light over Clock Face



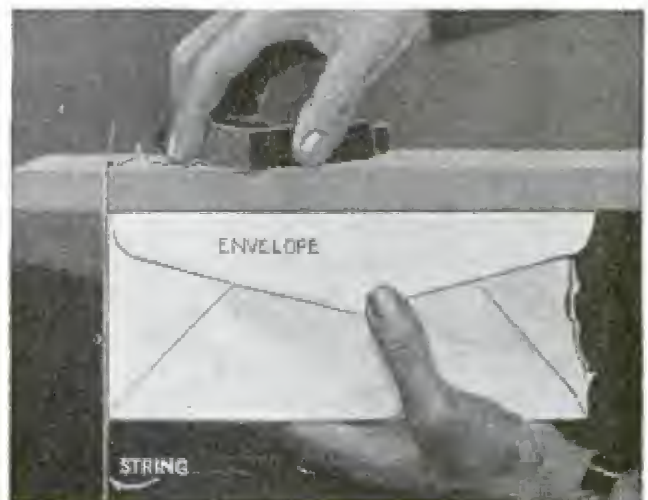
Flipping the tiny switch on the base of this clock holder lights up a low-wattage lamp and sends light through two glass tubes to illuminate the clock face. This arrangement of rods as shown above is particularly adaptable to a clock having a square face, preferably one which has exposed hands and hour marks, although the fundamental idea can be applied differently. The glass rods were part of a twin glass-rod towel rack, obtained at a dime store, in which the rods were spaced in a

similar way. Note how a small mirror at the end of the base is placed to reflect light up the rods. Any size base of good proportions can be used to enclose the lamp, the back being screwed on so that it can be removed quickly for lamp renewal. A radio panel switch is fitted at the end, front or top of the base. Also, vent holes should be provided for the escape of heat from the lamp. Small angle brackets are used to hold the socket and the clock face although it is advisable to use longer brackets to support the clock in order to avoid the tendency of the glass to break when drilled as close to the lower corners as in the original model. However, corner attachment such as this is satisfactory on metal faces.

Work Levelled in Emergency with String and Envelope

When a level is needed for checking shelves and framework and there is none at hand, one can be improvised with an envelope and a weighted string or plumb bob if the leveling job is not too critical. Just suspend the string from the work to be leveled and hold the envelope against both the work and the string as indicated. If the string touches the envelope along the entire edge, the work is level.

❑ If you have soot on a rug, cover it with dry table salt and let it stand a short time before sweeping.



Sorting "Tray" for Vegetables Saves Time



Opened and tacked to a pair of broomsticks, a burlap sack provides a handy tray for use in sorting or grading potatoes and vegetables in the home. The tray is spread on the floor, after which the vegetables to be sorted are spread on it. When sorting has been completed, the vegetables left are dumped into a container by merely lifting the tray by the broomsticks.

Stencils Cut from Old Negatives Last Indefinitely

Old celluloid photo negatives provide good material from which to cut small stencils. If necessary, they can be cemented together to make stencils of any thick-



ness. Use a sharp penknife or old razor blade for cutting. Do not cut through the negative, just score the surface deeply, then bend the material once each way at the cut, and the celluloid will part cleanly.

Bent Bail Keeps Paintbrushes Off Bottom of Pail

Instead of letting paintbrushes rest on the bottom of a pail of cleaner, which might cause the bristles to twist out of shape, a workman suspends them in the liquid. This is done by bending a loop in the center of the bail to engage the brush handle as shown.



Rings Soldered to Plumb Bob Provide Reel for Cord



Workmen who use a plumb bob with a long cord will find that a couple of narrow metal rings soldered to the bob as indicated provide a handy place to wind the cord. The rings will not interfere with the regular use of the plumb bob, and they keep the cord from tangling when in a toolbox.

Brass Shim Stops Relay Sticking

Sticking of relays and other electromagnetic devices because of residual magnetism can be avoided by inserting a brass shim over the face of the magnet core. The shim should be as thin as possible, as a thick spacer would interfere with the operation of the magnet.



MOVIE TITLES *that* "LIVE"

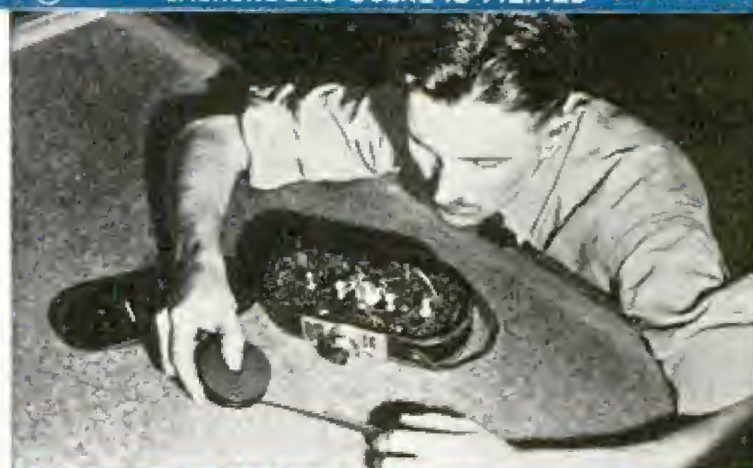
I NTERESTING and effective titles superimposed over still or animated backgrounds are possible with either black-and-white or color movies by the double-exposure method. Marine sunsets, inviting pastoral scenes, trees, flowers, mountains, city skylines and cloud formations all lend themselves to the purpose. For sports events and other shots involving fast movement, action backgrounds are appropriate.

The three steps shown in Figs. 1, 2 and 3 produce the attractive result in Fig. 4. Almost any scene can be used for a background, although the white lettering will show up to best advantage on one that is fairly dark in tone. Film the background at normal exposure. If your camera has a wind-back attachment, it is unnecessary to wind the film back in the darkroom. However, hand winding is not difficult especially if the background scene is taken at the beginning of a reel so you can just turn the film back all the way instead of keeping track of the footage. Titles must be lettered on a flat-black surface and may be made large and filmed direct, or small and used in a regular titler. For color film the lettering may be any color which contrasts well with the background. When taking the lettering, it is best to underexpose about one full stop.



①

BACKGROUND SCENE IS FILMED



②

FILM TURNED BACK IN DARKROOM



③

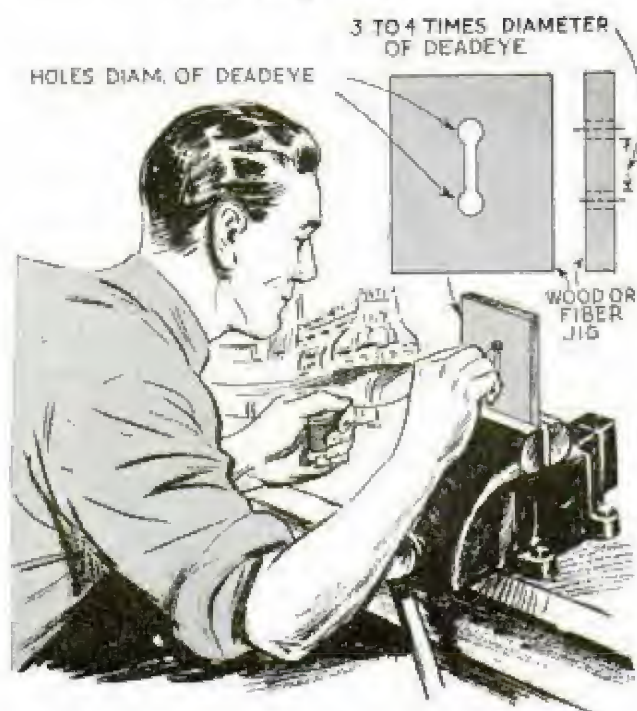
SHOOTING THE TITLE



④

AS THE AUDIENCE SEES IT

Jig Simplifies Rigging Deadeyes on Ship Models



The tiresome job of rigging deadeyes on a ship model can be done easily with the jig shown. In use, a deadeye is placed in each of the two holes drilled in the jig. The lanyard is then laced through the holes in the deadeye and fastened at the last hole. The completed assembly is removed from the jig by pushing it out.

—Fred Hushen, Brooklyn, N. Y.

Tray of First-Aid Equipment Quickly Slipped in Car

Fire chiefs and others responsible for first aid in emergencies will save time in many instances by keeping their equip-



ment in a tray built into the back of the car as indicated. If it is inconvenient to keep the tray in the car at all times, it can be put on tracks permanently attached to the car. This permits the tray to be removed when not needed and instantly slipped in place when a call comes in to the station.—J. L. Burden, Smithville, O.

Tubular "Pocket" on Typewriter Keeps Eraser Handy

Instead of throwing your typewriter eraser around on the stand or desk where it is hard to find, use this pocket to hold it. It is made from a short length of metal tubing which is flattened at one end and drilled to slip under the nut that holds the typewriter bell in place.



Imitating Spotlight Effects on Photographs



If you do not have a photo spotlight, you can imitate the effects of one when taking closeup pictures of

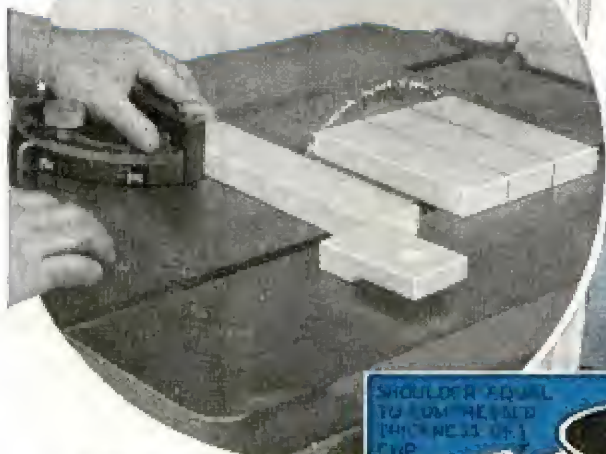
small objects. Just place an oval-shaped piece of white paper on black paper and set the object to be photographed on top of the assembly. Use one side light only, in order to cast a strong shadow.

Tip of Soldering Torch Shielded by Pencil Eraser

A slip-on type pencil eraser makes a handy cover for the tip of a small soldering torch. The eraser fits snugly and keeps from plugging the tiny opening.



STOP FOR CIRCULAR SAW . . .



MOUNTING GLASS SHELVES .



Everyday Uses for RUBBER SUCTION CUPS

Here are a few kinks with suction cups that make these versatile little gadgets still more useful. In the photos above, a cup holds a stopblock on a circular-saw table, and another supports a glass shelf on a windowpane. The cup edges should be moistened with glycerin, which prevents them from loosening quickly. In the photo at the right a suction cup serves as a pivot for a guide arm when cutting glass disks. Below, three cups hold a disk of plastic for very light turning in a lathe



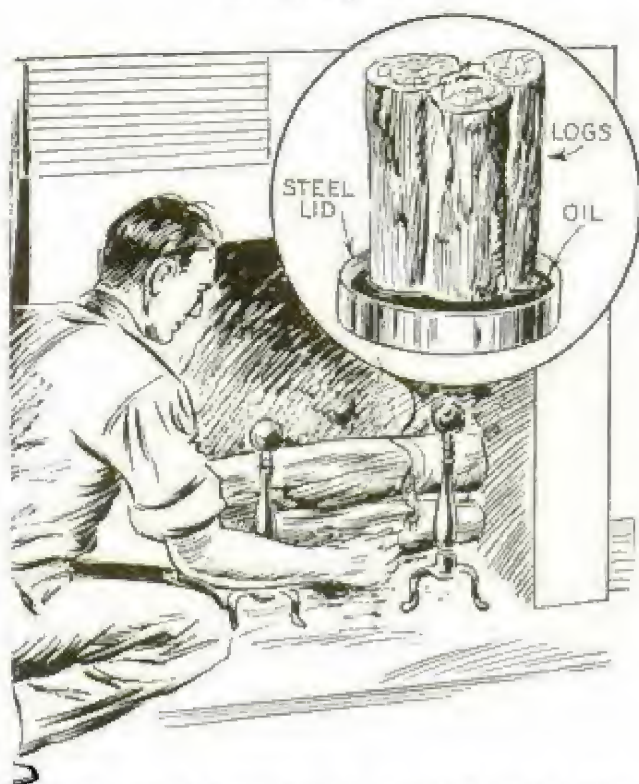
CIRCULAR GLASS CUTTER .



MOUNTING THIN PLASTICS ON LATHE . . .

Besides the applications illustrated, suction cups can be mounted on the outside of your car for carrying fishing tackle, in which case you attach small straps to the cups to fasten around the rods. Suction-cup hangers can be mounted on glass or any smooth surface for holding clothing, signs and lamps on your car or a workshop machine. They are useful to pull out indented portions of light sheet metal when the work cannot be reached from behind with a hammer

Oil-Soaked Logs Burn Briskly in Fireplace



Logs and chunks of wood for the fireplace that are too wet to burn properly can be made combustible with oil. Pour old crankcase oil in a container about 2 in. deep and set the wood on end in it. After a half hour or so, reverse the ends. The logs will absorb the oil at the ends, and when ignited in the fireplace, the flames from the burning oil will drive out the moisture where the oil did not reach.

Rubber Grip on Tool Handle Easy on the Hand

Fatigue and blisters on the hand may be avoided by using a rubber grip on the handles of files, chisels, etc. To make the



handles, cut a piece of the right length from a broomstick. Then drill one end to take the tool tang and slip a bicycle handlebar grip over the stick.

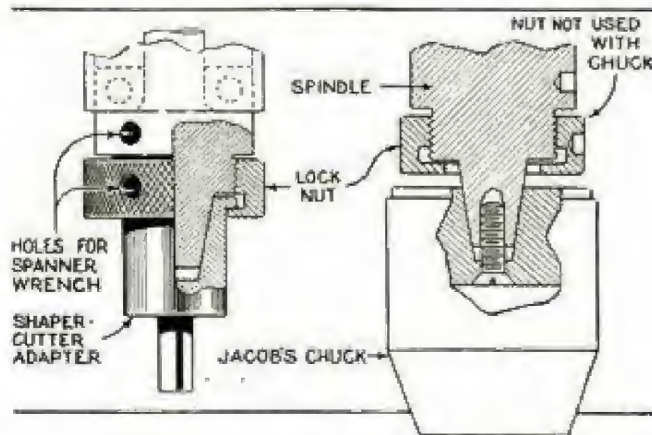
—Benj. Nielsen, Aurora, Nebr.

Rubber Cement Seals Shoe Seams Where Soles Are Attached

When you waterproof a pair of leather shoes or boots, don't forget the seams where the uppers are sewed to the soles. These places can be sealed with rubber cement such as is used for patching auto tires. First clean the seams with gasoline, then apply two or three coats of the cement.



Chuck "Screwed" to Drill Press When Routing



I have a small drill press on which the chuck is held by a tapered shank fitting into the spindle. Routing and shaping attachments are also provided, but these are held on by a special nut. When doing heavy drilling, the chuck sometimes loosens. To avoid this, I attach the chuck with a screw. This passes through the chuck, which is drilled for it, into a tapped hole in the tapered end of the drillpress spindle as indicated. The drilling and tapping must be done carefully so that the chuck will slip onto the spindle. This attaches the chuck so firmly that I can use it to hold routing and shaping tools.

—Carl N. Furay, Manchester, Conn.

Dip-Painting Flowerpots Gives Novel Effects



Colored paint can be picked up readily from the surface of water and deposited on ordinary clay flowerpots to obtain beautiful, variegated-color effects. Skill is unnecessary if you follow this simple method: First of all, the pot to be dipped must be thoroughly clean. Then the inside surface is given two coats of interior primer sealer (white, used for plastered walls). This will prevent moisture from penetrating the walls and causing the outside paint to blister. After the primer has dried, the pot is mounted on a holder, with which it is dipped and rotated in a water-paint bath. To prepare the bath use artists' colors ground in oil, obtainable in small tubes. Thin a little of each color with turpentine so that various colors can be flipped on the water with a small, thin paddle—not poured. Now, partly submerge the pot and slowly turn it completely around. Then lift it out of the water and continue turning until the color has soaked in and will not run. In this way several different colors can be applied simultaneously in pleasing, irregular patterns. Or, first you can brush a heavy coat of one color over the entire outer surface and after this has soaked in, apply other colors by the dip-and-turn process. White must be used a bit thicker than colors. If the water and paint are renewed for each pot, you will produce long, streaky effects. After the colors have dried, black enamel is painted on the bottom and on the inside surface

near the top. When dry, this is followed with two coats of waterproof varnish, both inside and out, to cover thoroughly and to produce a high gloss, which may be rubbed down to a dull finish.

Wire Bender Has Several Heads for Various Diameters

You will find this tool just the thing for bending wire and small rods. The work is clamped in a vise and then bent with the tool as indicated. Heads to handle various sizes of work can be made if desired.

—C. A. Hathaway, Davenport, Ia.



FASCINATING to watch and instructive to build, this combination unit comprises an alcohol-fired boiler fitted with a safety valve, a piston-type engine and a turbine. All of these may be mounted on a single base, as in Fig. 1, so that it will be an easy matter to connect the rubber tube on the steam supply line to either engine or turbine. Simplicity of

Diagram illustrating the components of a steam engine, showing an exploded view of the main assembly. Key components labeled include:

- FLYWHEEL
- HANGER
- BRONZE BEARING
- SHAFT #40 ROD
- CROSS SECTION OF FLYWHEEL CASTING
- 40 BORE
- FRAME, 5" X 5" X 2 1/2"
- BRASS ANGLE
- STEAM CHEST, 1 1/4" X 5/8" TUBING WALL
- COPPER TUBING
- ANGLE
- EXHAUST PORT
- VALVE, 1/6" X 1/2" ROD
- CYLINDER, 3/8" X 1 1/2" TUBING
- WATER RINGS
- STRAP, TUBING
- #40 CLOCK BUSHING
- #40 ROD
- WRIST PIN, #56 ROD
- PISTON, 3/8" X 1 1/2" BRASS ROD

Diagram 5 illustrates an eccentric crank mechanism. It shows a crank with a $\frac{1}{4}$ " throw and an eccentric with a $\frac{3}{16}$ " throw. The eccentric is offset by 75° from the crank's centerline.

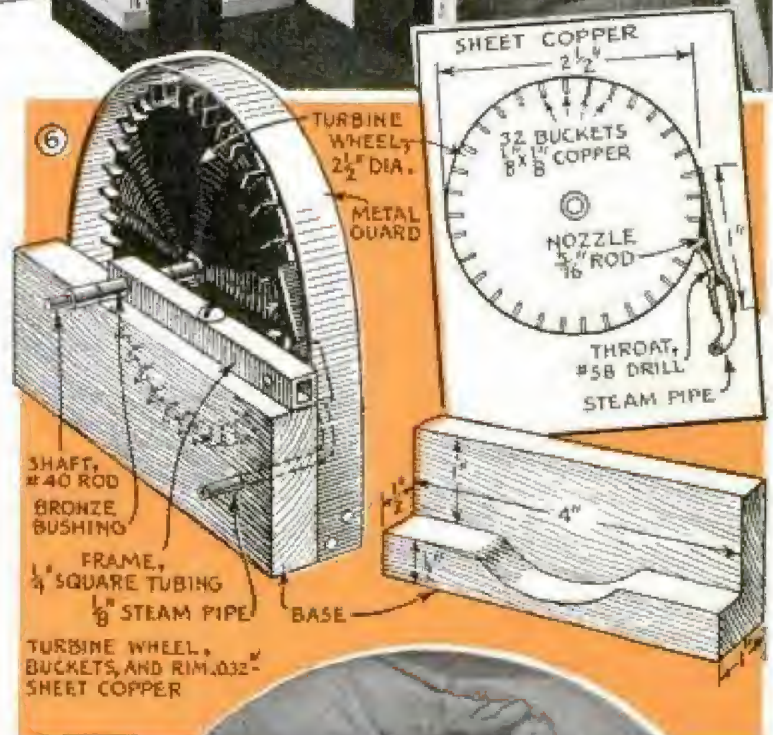
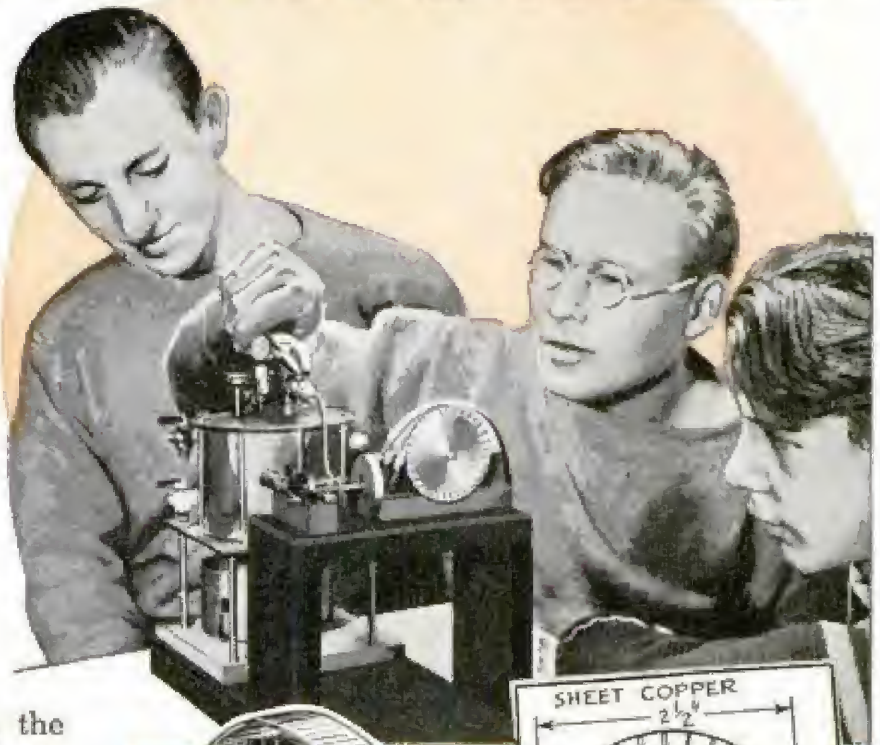
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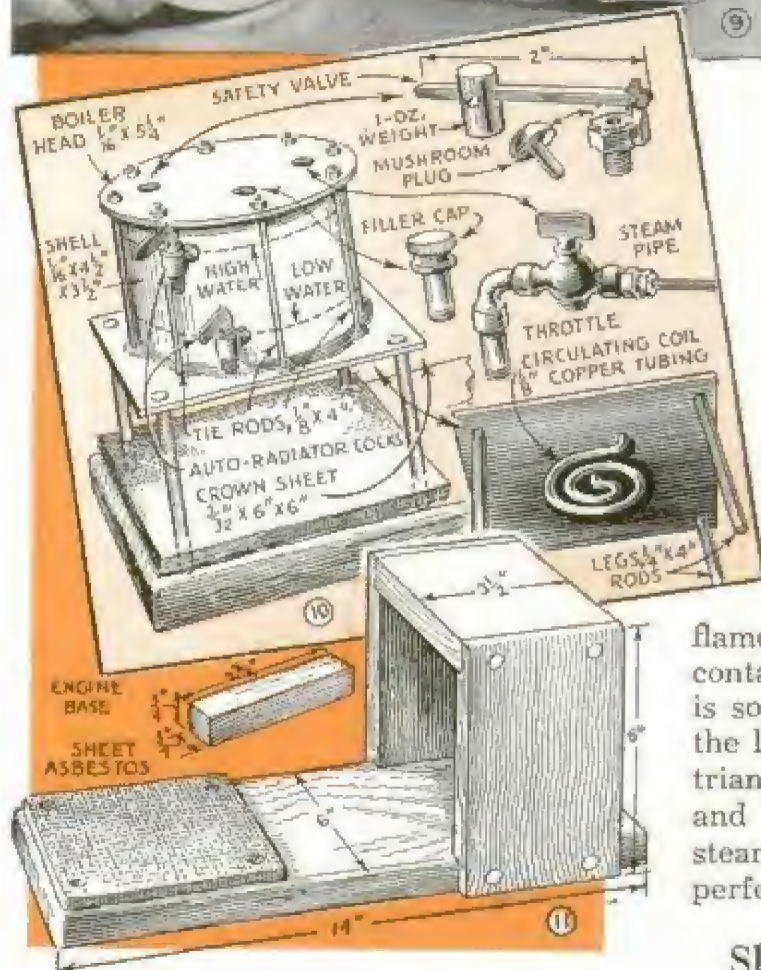
STEAM ENGINES

the outward, or power stroke. While the piston is completing this stroke with the steam pressure forcing it outward, the valve is moving in the opposite direction. Just before the piston reaches the back dead center, the valve closes the live-steam port and by the time the piston starts the return or exhaust stroke the valve has moved into the position shown in the right-hand detail, Fig. 4. This allows the exhaust steam to pass out through a port drilled in the body of the valve.

Thus the cycle is completed, the one opening into the cylinder acting as both inlet and exhaust port.

An alloy solder with a high melting point, 500 to 550° F., must be used. Ordinary tinner's solder will not do. However, before assembly all bearing surfaces of cylinder, piston, valve and steam chest must be tin-plated. This is necessary because contact with live steam produces an oxide film on brass, making the surface rough. Sprinkle pure tin salts on the surface to be tinned, apply heat until the tin is liberated and spreads over the surfaces. While a batch of lead is melting in an





iron ladle, turn the wood mold for the fly-wheel, Fig. 7. Although the wheel is shown separate from the shaft in Fig. 3, it is actually shrunk onto the shaft by simply placing the latter upright in the mold before the metal is poured. This done, the engine is put together complete, except the crank which is pressed on the shaft but not soldered. Connect the engine to an air line furnishing about 10 lbs. pressure. Then move the crank on the shaft until you find the point where the engine runs best, and solder the crank in place.

In the turbine, a jet of steam is directed against buckets on the rim of a disk wheel

as in Figs. 6 and 8. The nozzle is made of $\frac{5}{16}$ -in. brass rod filed to the shape indicated. The opening in the nozzle is cone shaped by drilling a number of holes of progressively smaller sizes, finishing with a No. 58 drill. The shoulders are smoothed up with a file. Finally the nozzle is filed down to the curvature of the wheel rim and is fastened securely so that the rim just clears. The throat opening is located on a line tangent to the circumference of the wheel. Carefully made, this wheel is capable of very high speeds.

A good boiler, which is simple and safe, is shown in Fig. 10. A circulating coil and an alcohol burner, Fig. 9, make it steam in about half the time ordinarily required. Soldering the boiler is very important. The open ends of the shell must be filed or turned true so that the joint at the head and crown sheet, Fig. 10, is perfect. Then tin the meeting parts for a space of $\frac{1}{2}$ in. each way from the joint. Assemble the boiler with the tie rods and heat over a

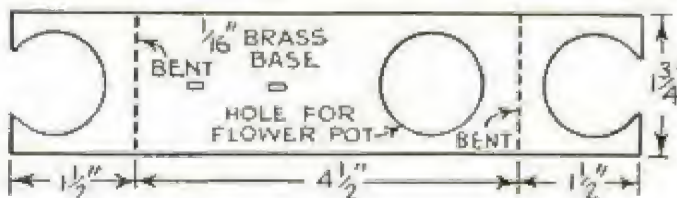
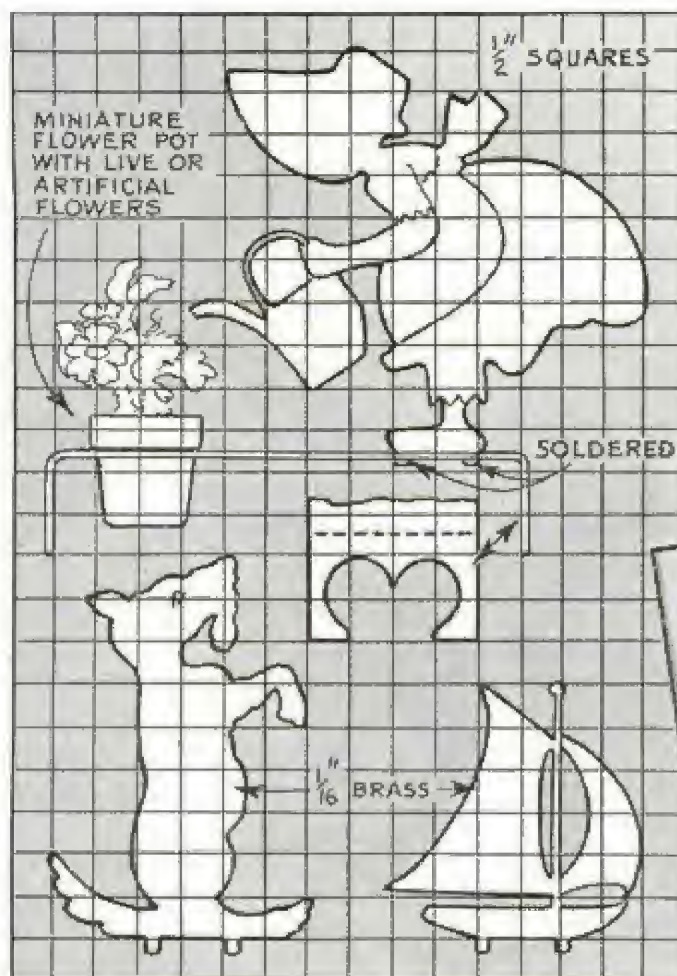
flame, taking care that the latter does not contact the tinned joints. When the metal is so hot that hard solder will flow, hold the latter against the joints building up a triangular fillet all the way around, top and bottom. To make the safety valve steamtight be sure that the two parts seat perfectly.

Slotted Stopper Vents Funnel When Filling Bottles

When filling bottles and other small-mouth containers with the aid of a funnel, a cork or other stopper slotted as shown, when put in the mouth of the container with the funnel, will allow the air to escape. Similar results can be had by using a short piece of hose with a section cut out to provide a slot.



Novel Shelf and Table Ornaments in Brass



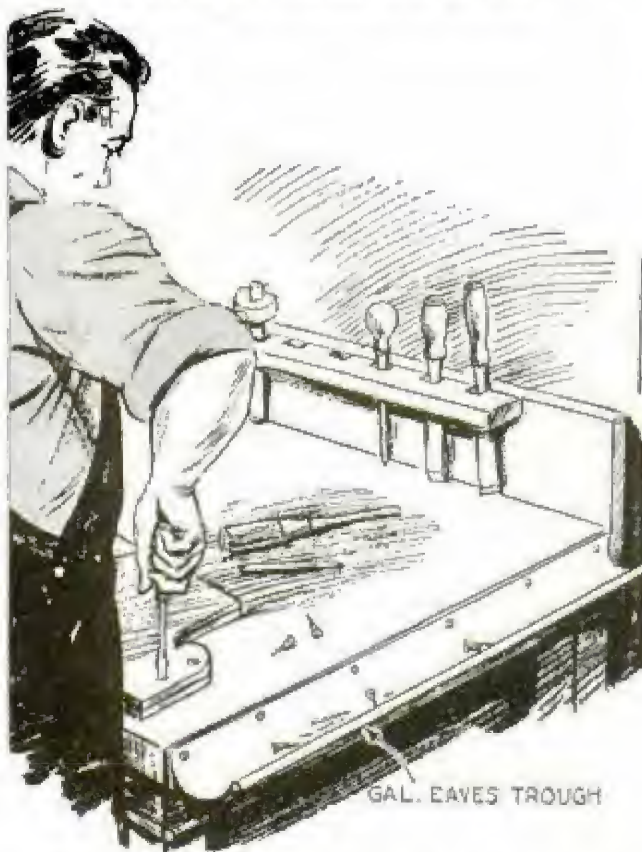
These little sheet-brass ornaments are just the thing for decorating a table, radio or to set on whatnot shelves. After enlarging the figures by drawing them on paper marked off in $\frac{1}{2}$ -in. squares, they are cut out and pasted to $\frac{1}{16}$ -in. brass to serve as patterns in jigsawing the metal. Each figure is attached to a base, which is cut from the same material and has a hole near one end to take a miniature flower pot. Both ends are cut away as indicated and are bent downward to provide legs. The figures can be painted in bright colors or they can be left in silhouette form. In the latter case, the silhouette may be painted in solid color or the brass can be buffed or rubbed with fine steel wool to give a satin-like finish. If the brass is finished in natural color, a coat of thin, clear



lacquer should be applied to prevent tarnishing. The flower pots are wood or porcelain and can be obtained from your local novelty store or flower shop. They may be used to hold artificial flowers, or if desired, you can fill them with rich soil and grow cactus and other live flowers.

—H. R. Wallin, New York, N. Y.

Trough on End of Workbench Catches Small Articles



Extending across the ends of a workbench, short lengths of small eaves trough will help prevent small articles, such as drills, punches, etc., from rolling off on the floor. The ends of the troughs are left open so that sawdust and shavings that collect in them can be removed easily.

Simple Motor-Reversing Switch

I find that a four-way toggle switch is better than a single-throw knife switch for reversing repulsion-induction motors and those of similar type having four leads. The four-way switch is always closed so

that there is no possibility of burning out the motor when the single-pole starting switch is turned on, which might happen with a knife switch if it is open when starting the motor. The four-way switch is connected as shown by the wiring diagram, and both switches may be housed in a 4-in. outlet box, making a neat installation.

—Albert F. Mueller, New York City.

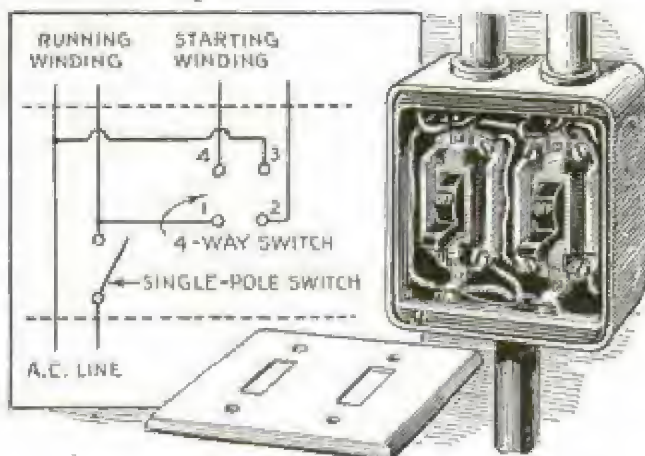
Stovepipe and Straw Insulate Water Pipe

In running a water pipe from a storage tank to the house, the vertical portion above the ground was protected against freezing with straw and stovepipe. First a section was dropped over the pipe and down to 3 ft. below ground. This was packed with straw, the pipe being kept

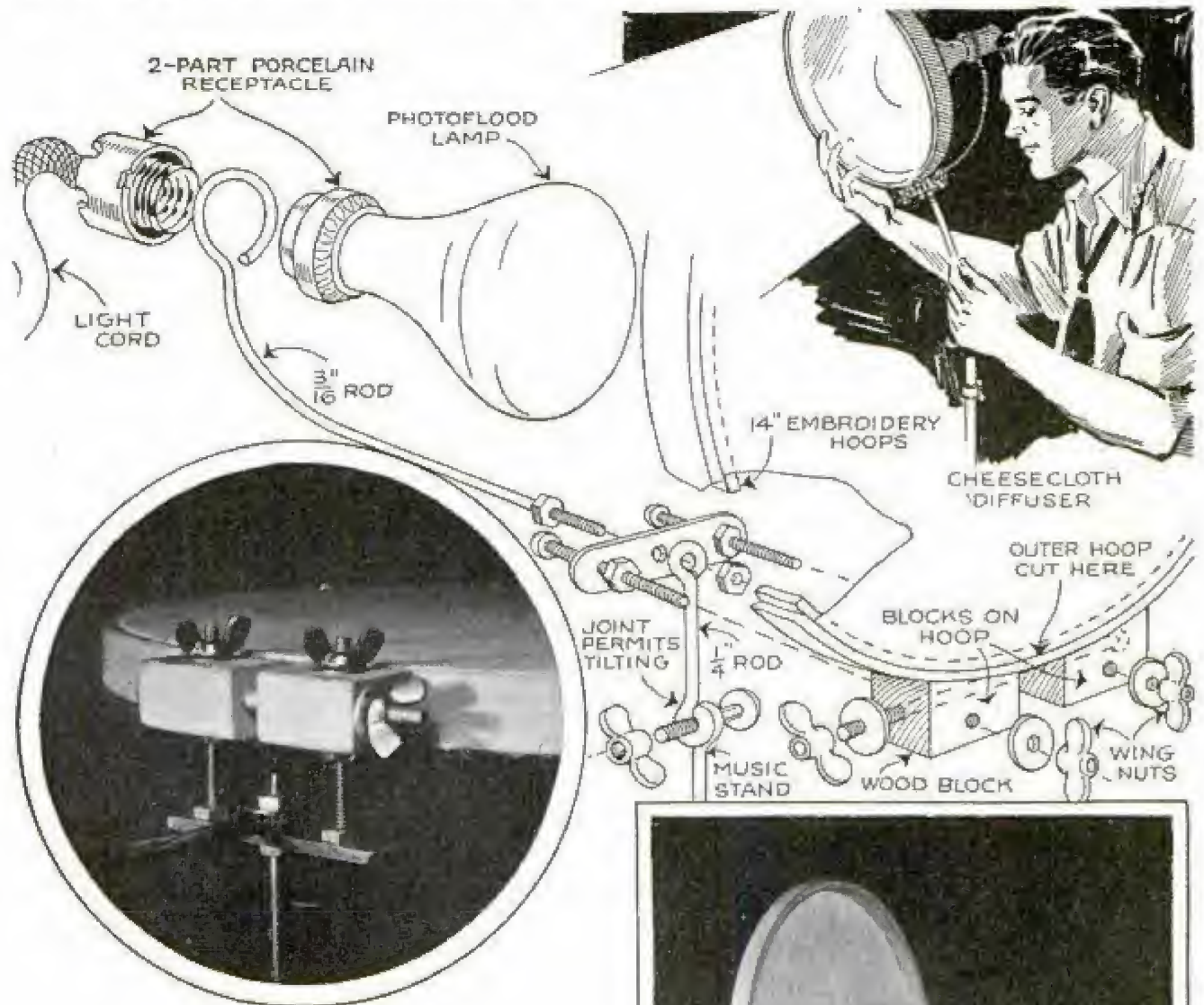


well centered. Then the next section was put in place and packed with straw, continuing until the top of the pipe had been reached. Asphalt was applied to the joints to keep out moisture, and the whole column was given a coat of aluminum paint.

Stubborn lipstick stains will disappear if you sponge the stain with carbon tetrachloride before laundering the article.



Tilting-Head Stand for New Photoflood Lamp

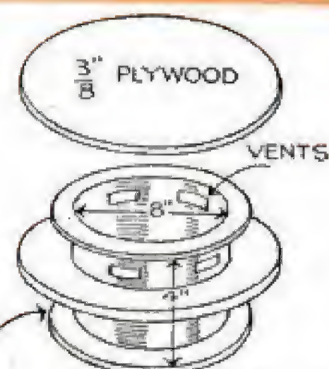
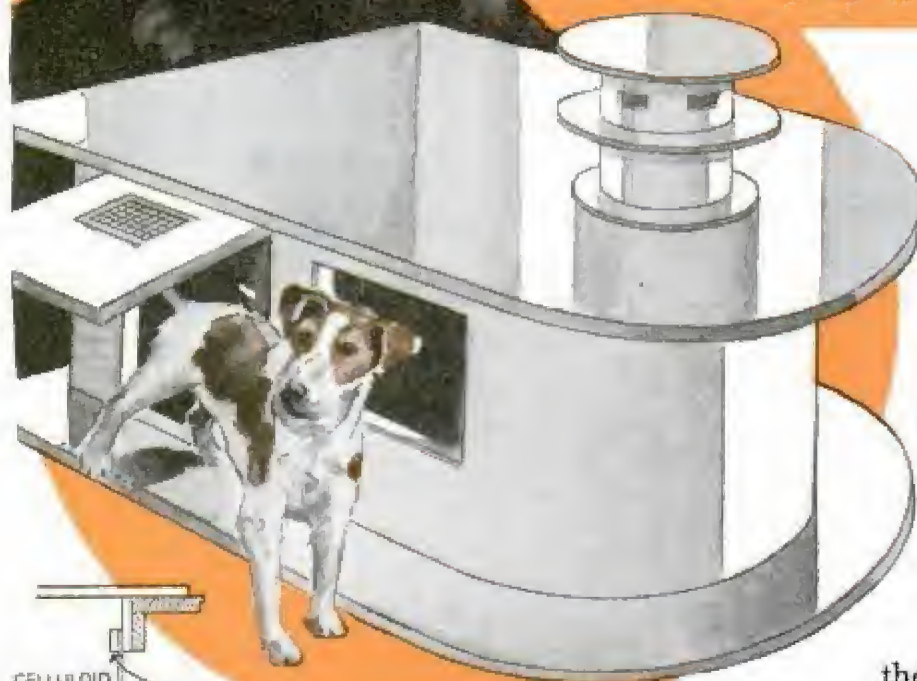


Needing a tripod to support a cheese-cloth diffusing screen and one of the new photoflood lamps while taking portraits indoors, I made this head and pivoted it to a music stand so that the head could be tilted and locked at any desired angle. As shown in the details, the lamp is held by a curved rod with an eye on one end, which is clamped between a two-part porcelain sign receptacle. Embroidery hoops provide a frame for the diffusing screen. They are attached to the head by means of two wood blocks glued to the underside of the outer hoop and drilled to take bolts projecting from the head. The outer hoop is cut away between the blocks, which are drilled transversely for a bolt to draw the hoop tightly around the inner one to clamp the cloth tightly. The diffuser can be removed when not needed by simply unscrewing two wing nuts. Tilting of the

head is accomplished by a short rod having eyes formed on both ends. One end is pivoted to the music stand by a short bolt and wing nut and the other end is fastened to the head by means of the lamp-supporting rod, which is threaded to take a nut. An inexpensive chromium-plated music stand is used to support the fixture.

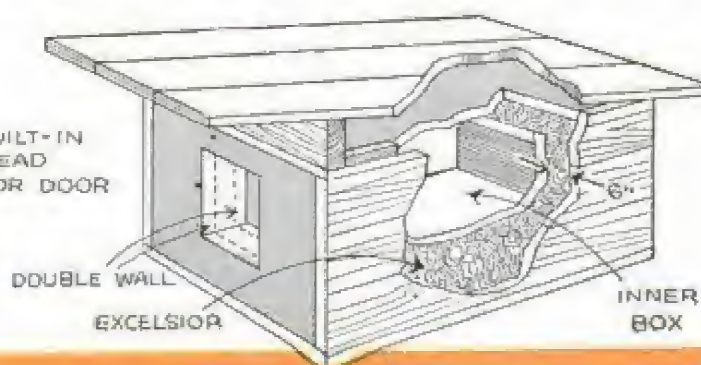
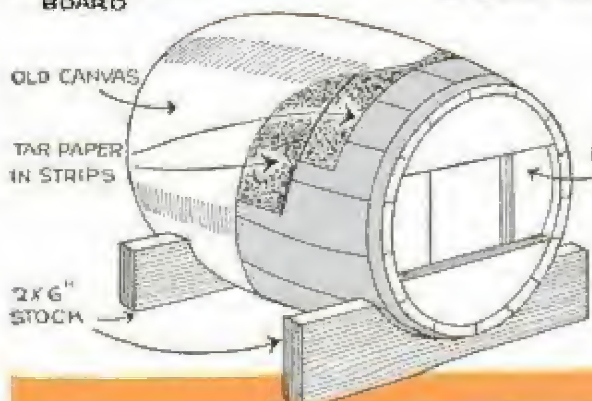
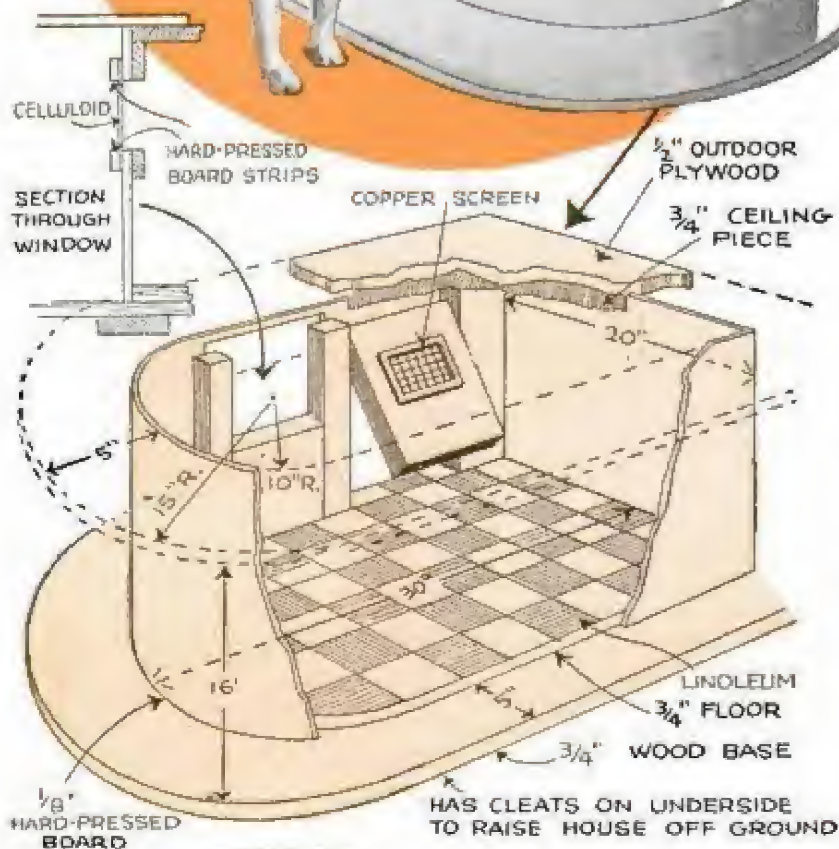
—Arthur Trauffer, Davenport, Ia.

DESIGNED

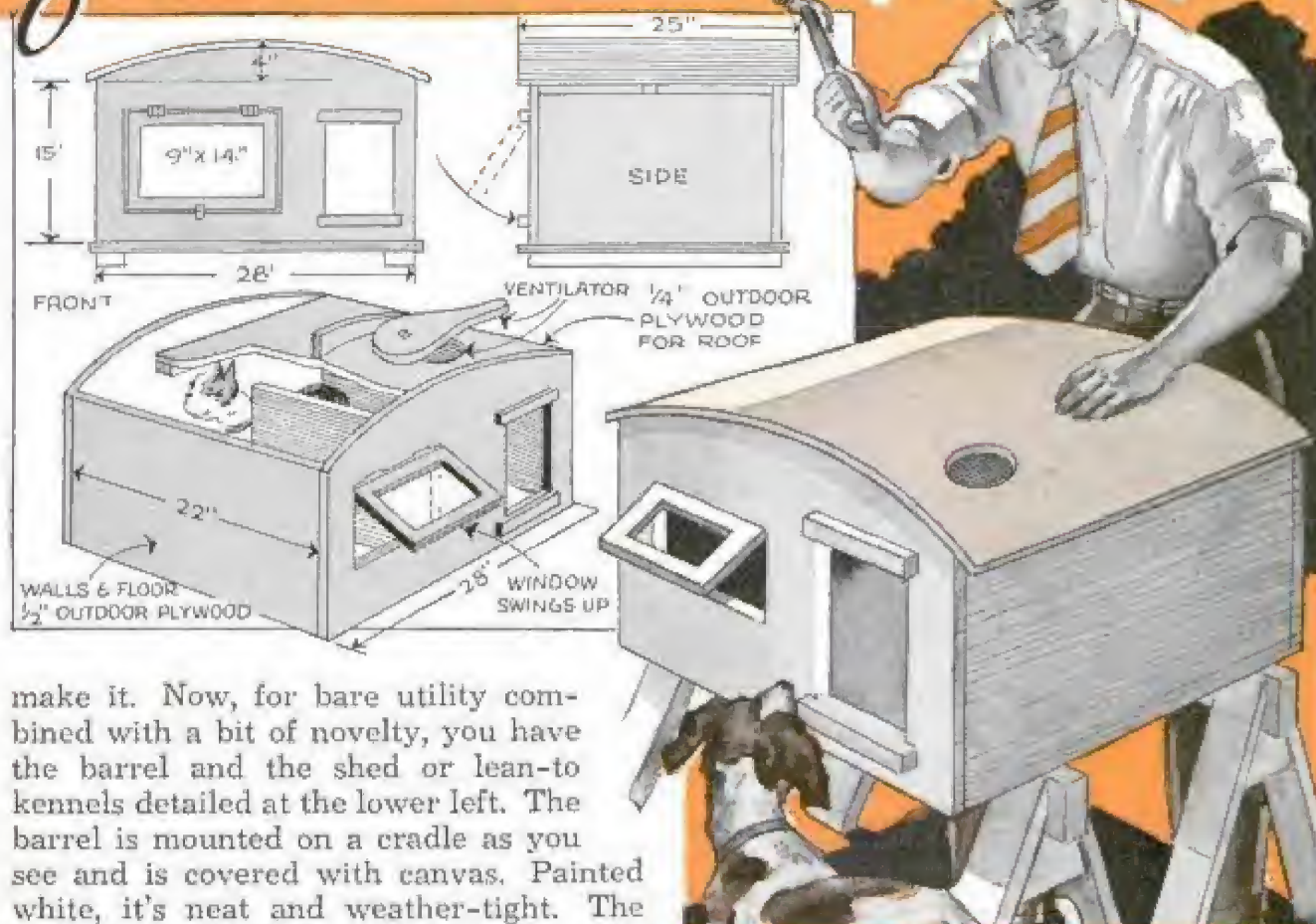


GALV. SHEET-FLANGES SOLDERED ON

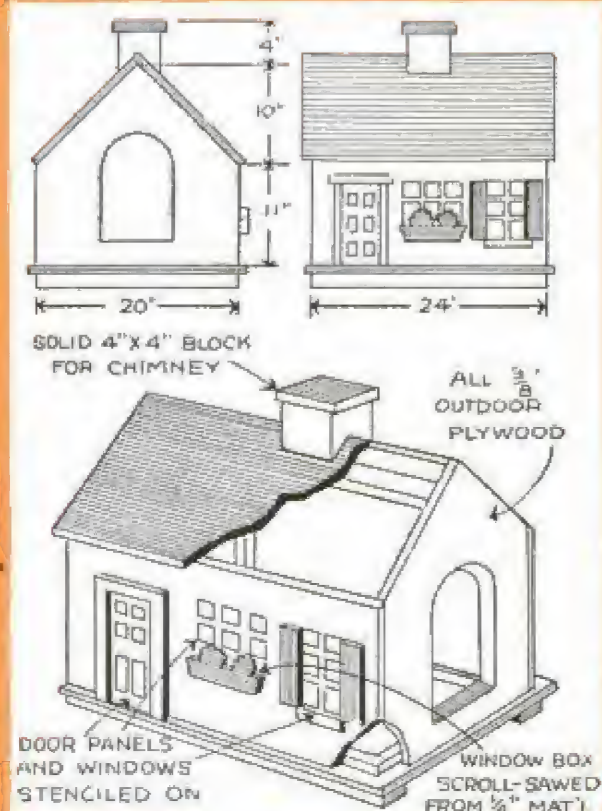
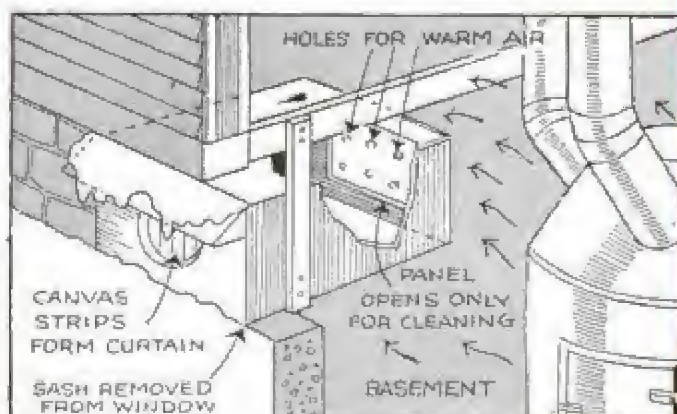
CALL them just plain doghouses if you will, it's certain your dog will be quick to show his appreciation of any one of them, and that in his own way. Most dogs won't be fussy about the architectural details; even canine aristocrats are not likely to turn away from a barrel house or a box with a lean-to roof, provided it's warm and clean. Looking at any one of these designs you will see that they fill the latter two requirements without even considering the degree of ornamentation on several of them. Taking the various designs left to right, the first one at the upper left is a rather showy affair of a distinctly modern type made of plywood and hard-pressed board. The detailed view at the left shows you how to



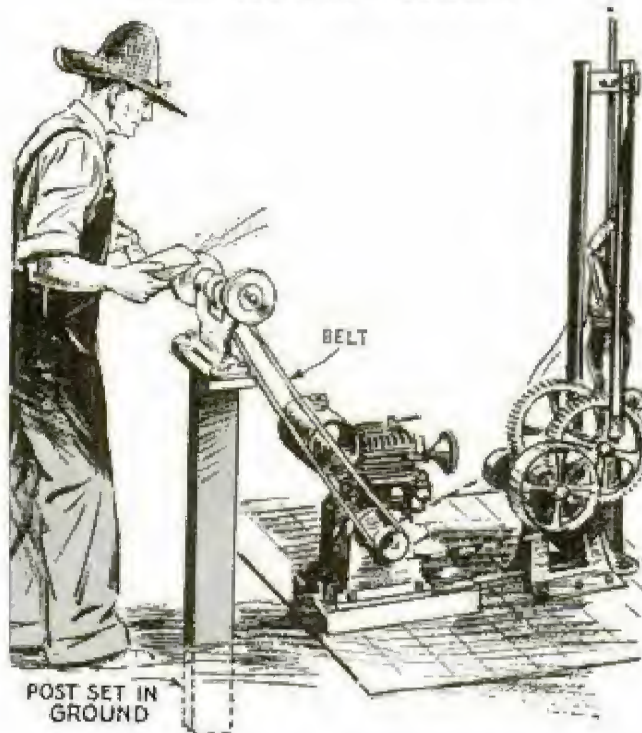
for DOGS



make it. Now, for bare utility combined with a bit of novelty, you have the barrel and the shed or lean-to kennels detailed at the lower left. The barrel is mounted on a cradle as you see and is covered with canvas. Painted white, it's neat and weather-tight. The other is simply a box within a box, the space between the double walls thus formed being filled with excelsior to insulate the interior. The "hanger"-type kennel at the upper left features a vestibule, adjustable ventilator and an up-swinging casement window. At the lower right you have the Cape Cod cottage which will house your pet in snug comfort the year 'round. Directly below is the basement apartment with ground-level entrance. Holes in the back permit warm air to enter.



Water-Pumping Engine on Farm Also Drives Grinder



One farmer who pumps water with a small engine also uses it to operate a grinder for sharpening tools. A post is set solidly in the ground near the engine to support the grinder, and a belt runs from this to the engine. When not needed, the belt to the grinder is removed so that the engine can be used for pumping water.

Trouser Belt Serves as Lens Shade in Emergency

Lack of a camera lens shade did not bother one photographer, who simply removed his trouser belt, rolled it into a cone



shape and used it as an emergency shade. The belt, of course, had to be held in place with the hands while taking the picture.

Pinch End of Acid-Core Solder After Cutting Off Piece

When you use acid-core solder always pinch the end with a pair of pliers to keep the acid from leaking out. Besides losing the acid for soldering purposes, it will damage other tools with which it comes in contact.—V. Robinson, St. Paul, Minn.



Tool-Handle Wedge Held Tightly by Corrugated Fastener



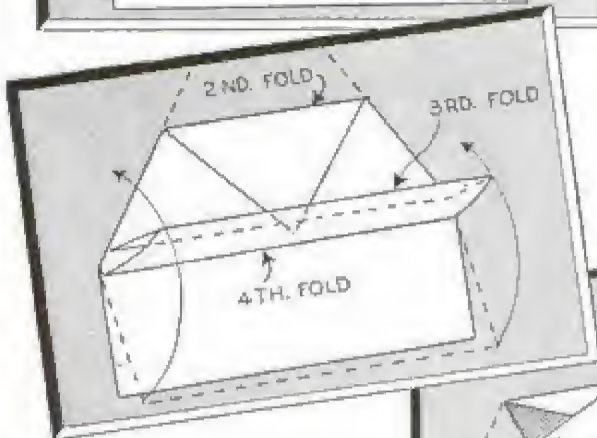
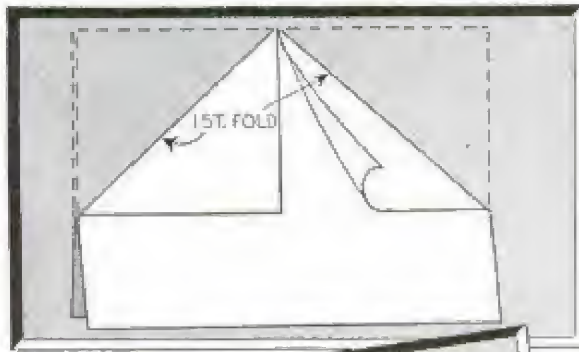
If a wooden wedge in the handle of a hammer, ax or other tool tends to work out, drive a corrugated fastener into it. Start the fastener diagonally across the wood so that it enters both the wedge and the end of the handle.

Index Indicator on Lathe Speeds Work

Instead of counting the holes to the next division when using the index head on a lathe, try this indicator. It is set easily to any position and will show the next hole for the index pin without repeated countings. The indicator is shaped from sheet metal and is slipped over the headstock-spindle housing where it is turned to any position desired.



Snug Skull Caps of Paper Are Easy to Fold

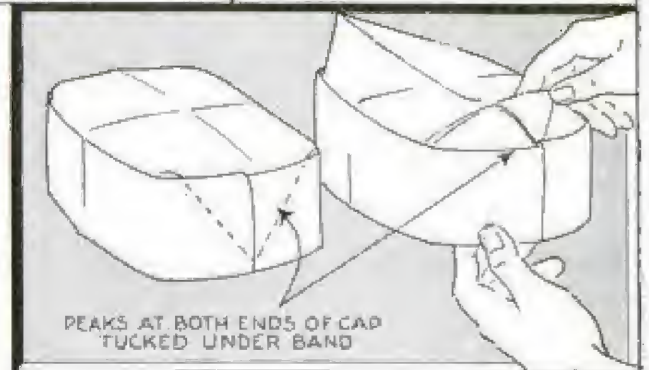
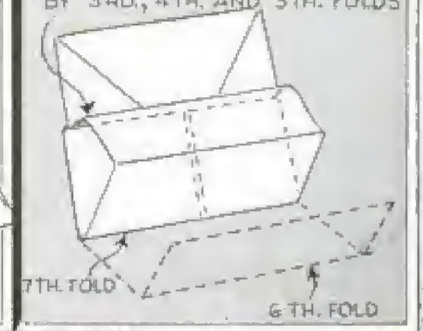


By following these simple steps anyone can form these trim caps which need no pins or glue to hold them together



PAPER IS TURNED OVER BEFORE MAKING 5TH. FOLD

FLAP IS TUCKED IN POCKET MADE BY 3RD, 4TH, AND 5TH. FOLDS



A double newspaper sheet makes one of these caps. The strength and shapeliness of the cap depend on the care in creasing the paper at each fold. To start, you lay the doubled newspaper sheet on the table in front of you and fold down the corners so that the edges of the folded portions meet, as shown in the top detail. Then the second, third and fourth folds are made, after which you turn the whole thing over as indicated, before making the fifth fold. The latter is really two separate duplicate folds as you will see in studying the detail. After the sixth and seventh folds, which should be very accurate, the

flap remaining is tucked in a pocket formed by the third, fourth and fifth folds. Lastly, the peaks are tucked under the band at both ends.

—W. R. Greer, St. Paul, Minn.

Tubular Furniture Assembled with Babbitt Plugs Instead of Wood

In constructing tubular furniture, I have found that babbitt plugs provide better construction at the joints than hardwood plugs. To use the babbitt, first drill a small hole through one side of the tube, then force a paper wad into it just below the hole. The paper retains the molten babbitt and the hole serves to anchor it in place.

Before pouring the babbitt, turn a nut on a painted bolt flush with the end and center it in the end of the tube with the nut next to the paper. Lock the tube in a vise with one of the jaws over the hole to retain the babbitt. Let stand until the metal has cooled, then back out the bolt.

—K. F. Keith, St. Petersburg, Fla.



"Tear-drop" body provides sleeping quarters for two adults on a full-size bed, besides storage room for six or eight cots or sleeping bags to accommodate as many persons on a week-end trip. There is a large cabinet for food supplies, a sink with running water, stove, worktable, and a cork-insulated icebox with a water-sealed drain. The trailer body is only 9 ft. long, 5 ft. 9½ in. wide and the weight complete ready for the road is approximately 960 lbs. The trailer is balanced so nicely that one man can move it about easily when detached from the car. Although material costs will vary, \$125 will be a fair average.

Part I—By CHARLES W. BRENTNER

GLANCING casually at this little job gives you the impression how much can be done in a small space, how smart it appears in modern streamline design, and how easy such a small trailer should be on your car. Going through the photos, constructional drawings and details as given in this article, you will agree that it is surprisingly complete in its accommodations and provides all the comforts on the road that the average person demands. While it is classed as a midget in comparison with the size of most house trailers, it is just the thing so many people want for greater enjoyment of week-end or vacation trips.

Being light in weight, you will have no cause to worry about undue clutch and rear-axle troubles due to excessive wear. Also, there's no sidesway which is often responsible for uneven tread wear on the rear tires of the towing car. This elimination of sidesway is due to the manner of springing the trailer body to the axle.

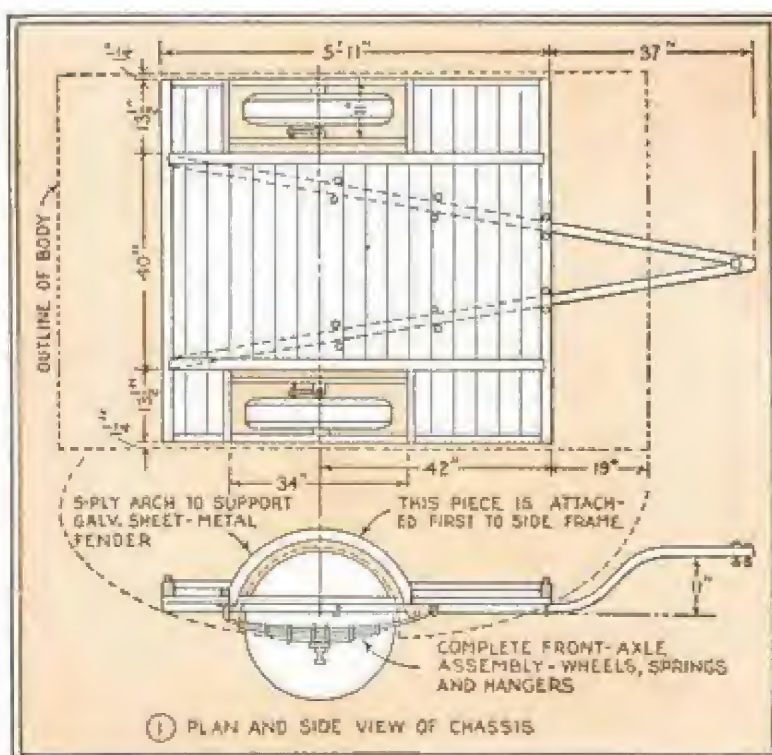
The material list gives the general sizes and the quantities of stock and incidentals required for the construction of the chassis and body frame. Of course, allowances are made on the various items for cutting and fitting. In the matter of woods designated in the list, substitutions can be made, if

MIDGET TRAILER

serves your vacation needs



desired, but it should be kept in mind that the body has been designed for maximum capacity in the minimum of space. For this reason the stock sizes of the chassis and body framing have been worked out carefully to give the greatest strength possible with the fewest number of parts and still keep the weight under a given figure. If it happens that you can't get spruce for the parts as specified, pine is a substitute, but in equivalent sizes lacks the strength of the former wood. Oak gives a sectional strength equal to spruce but adds to the weight. In this latter instance, a good compromise would be the use of oak for the chassis frame and pine for the body framing. Adding metal corner plates and iron angles attached with screws will greatly





strengthen those parts that are made of pine.

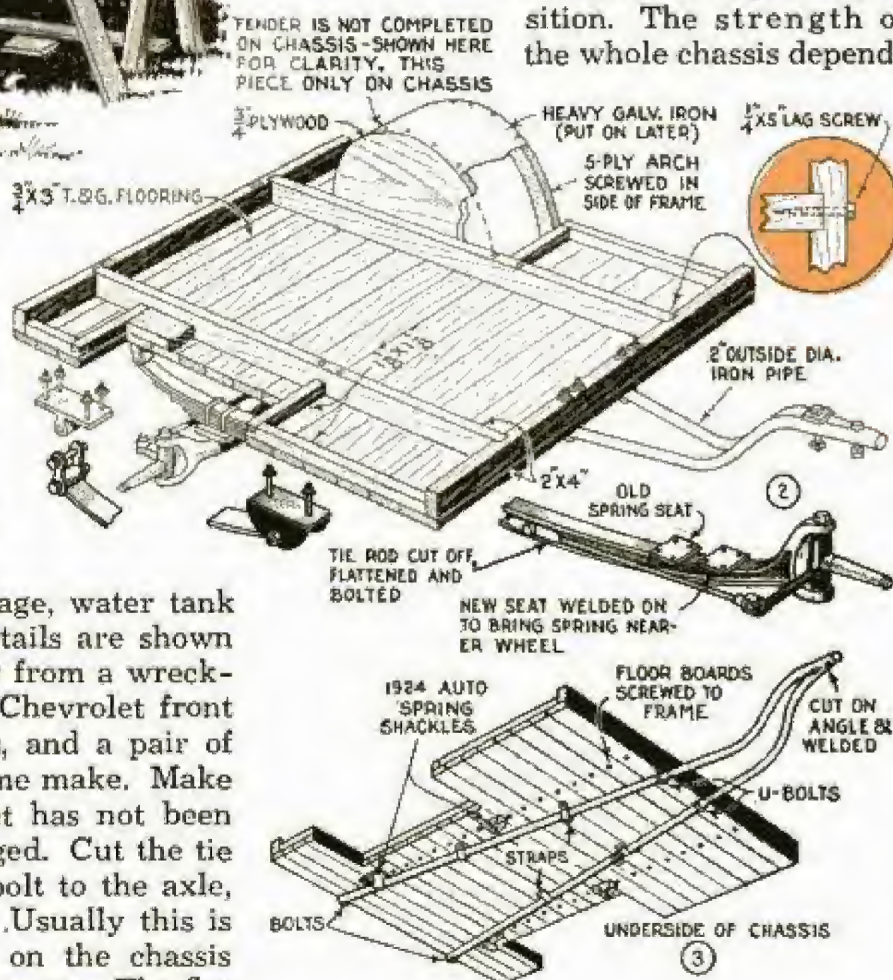
Chassis: General dimensions of the chassis are given in Fig. 1. You will note that the floor area is relatively small, in fact, passengers stand only on a small portion inside the door when getting in or out or putting on shoes while sitting on the bed. The remainder of the floor supports baggage, water tank and battery. Assembly details are shown in Figs. 2 and 3. First buy from a wrecking yard a standard 1924 Chevrolet front axle, springs and shackles, and a pair of 1930 disk wheels of the same make. Make sure that the axle you get has not been sprung or otherwise damaged. Cut the tie rod, flatten the ends and bolt to the axle, after aligning the wheels. Usually this is best done after installing on the chassis and aligning with the towing car. The flat ends of the tie rods, after aligning the wheels, are clamped to the axle and then drilled to insure true register of the holes. A new spring-seat is welded near the wheel on each end, Fig. 2, to bring the point of suspension nearer the wheel, thus preventing sidesway on the road.

The tow bar, Fig. 3, is in the form of a vee, made of a pair of 2-in. iron pipes bent to an upswing at the forward end, the ends beveled and welded at the tip, as shown; then two holes are drilled for bolts through the trailer hitch. The latter should be of

a standard make having a ball-and-socket fitting. At this point provision should be made for running the lighting and taillight wires through the left-hand pipe.

Now build the chassis frame as shown in Fig. 2, screwing the tongue-and-groove floor boards to the 2 by 4-in. cross members while the frame is upside down. Next, install the tow bar and the spring shackles. In making up this structure, there are several points to watch. Make certain that it is square and that it remains so until you get all the floor boards screwed in place. Tack on temporary braces, if necessary, to

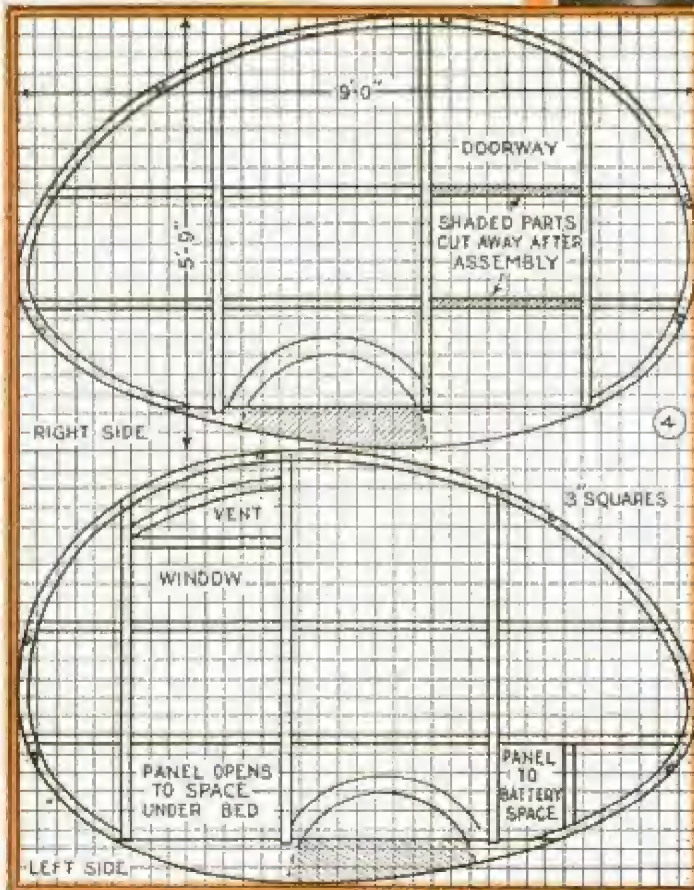
hold it in the squared position. The strength of the whole chassis depends



on the care with which you assemble this part of the structure. The housed joints joining the 2 by 4-in. members should be a snug fit. If the joints are an imperfect fit, the vibration and strain to which the parts are subjected will cause them to loosen to such an extent that the lag screws will not hold effectively. Turn the chassis over and set up on sawhorses to keep it steady while going ahead with the construction.

Body frame: As specified, spruce is the best wood to use for the body frame. If it

is not available then use selected white pine. Practically all frame members are $1\frac{1}{8}$ by $1\frac{1}{2}$ in., the curved members, Fig. 4, being bandsawed from 8-in. boards. To simplify the work, lay out a squared diagram full size on the garage or workshop floor, Fig. 5, and outline the entire frame. It then will be an easy matter to get each piece in proper proportion and location. Note that right and left frames are practically the same, Fig. 4, and are altered simply by cutting away different portions in each. This method keeps

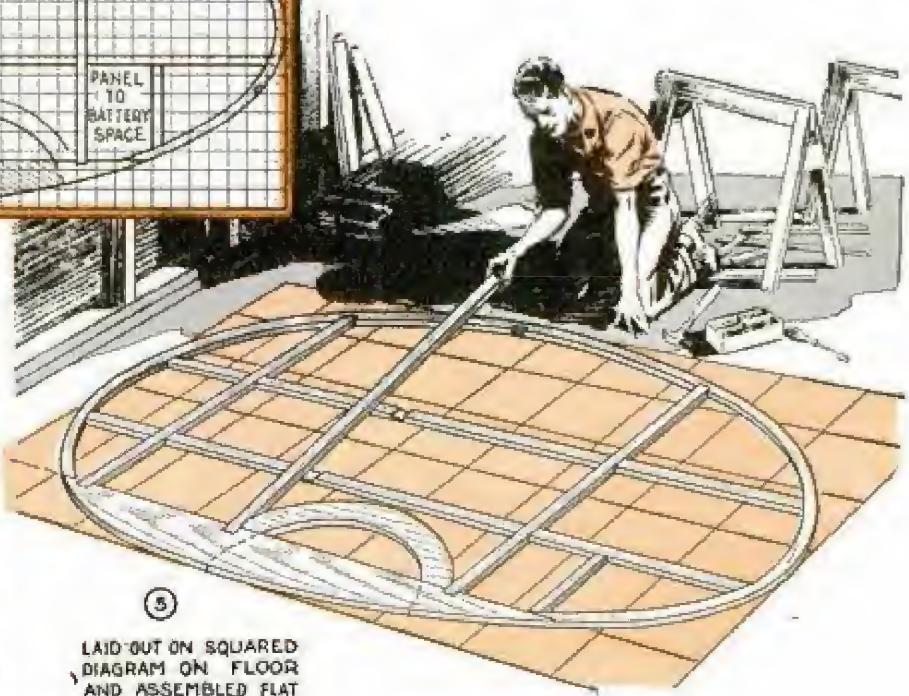


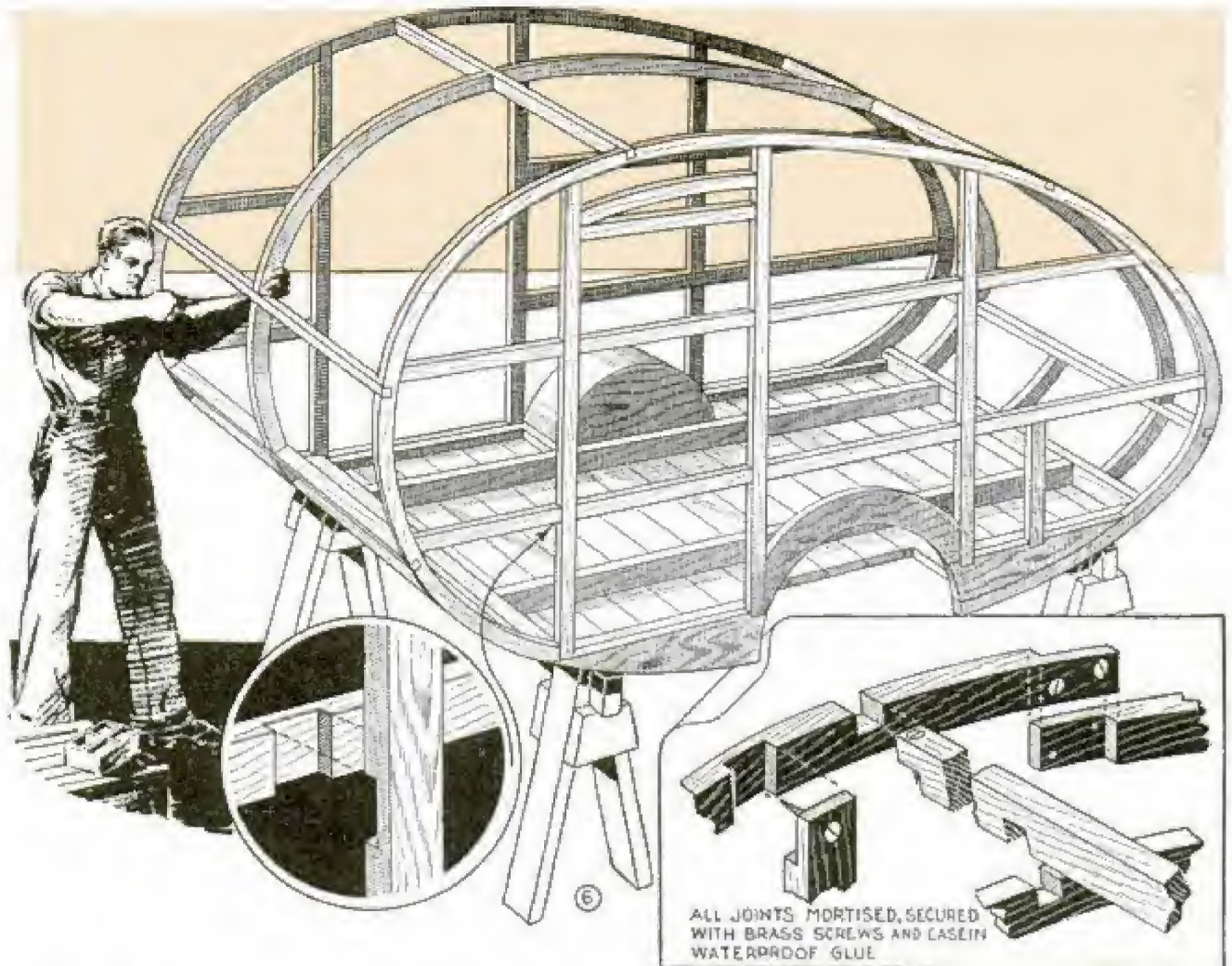
the frame true until entirely assembled. The finished job, with the frames joined by the crossbeams, will appear as in Fig. 6. Casein glue and brass screws are used throughout.

In assembling these frames keep in mind that strength depends largely on the accurate fitting of the joints. The lower details in Fig. 6 show the variations in half-lap joints used in the assembly. As you see, there is no cross bracing on the framework itself. Rigidity depends entirely on the strength of the individual members, the accuracy of the joinery and the sheathing material which goes over the frame-

MATERIAL LIST

- 1—1924 Chevrolet front axle, complete with springs and shackles
- 2—1930 Chevrolet disk wheels and tires
- 2 pcs. 2-in. iron pipe, 9 ft. long—tow bar
- 1 standard trailer hitch
- 36 sq. ft. T & G flooring ($\frac{3}{4}$ -in. net)
- 3 pcs. 2 x 4-in. x 6-ft. pine—chassis frame
- 96 lineal ft. $1\frac{1}{8}$ x $1\frac{1}{2}$ -in. (net) spruce—framing
- 10 pcs. $\frac{1}{8}$ x 8-in. x 5-ft. spruce—curved members
- 1 pc. 30 x 30-in. spruce—fender supports
- 1 pc. 15 x 36-in.—for removable panels on left side to storage and battery





work. For the purpose of clarity the body framework is shown assembled in Fig. 6, but in actual procedure the side frames are first used as templates to lay out and cut the sheathing, which is of $\frac{1}{8}$ -in. hard-pressed board. This will be covered in Part II, which follows in an early issue. The center member, Fig. 6, is cut to the same curve as that of the side frames. It is assembled full length and after installing a header, a portion of it is cut away at the rear of the body and used as a center rib for the flush lid which closes the "kitchenette." Now, while you have the construction at this stage, is a good opportunity to paint all the parts. Use a priming coat first, thinned so that the wood will absorb a good portion of it. Then follow with at least one coat of full-bodied paint in the color desired. Be careful to work the paint well into the joints, particularly the openings between the floor boards, in fact, it's a good idea to prime the tongue-and-groove edges of the floor boards before you lay them. Also prime the top edge of the chassis frame members. These latter precautions

will prevent absorption of moisture. If you decide to prime the side members remember that certain parts will be exposed in the finished job. So it's well to smooth up with sandpaper before applying paint.

(To be continued)

Oilcan Is Handy Gluepot

A handy container for glue, cement or shellac can be made in a jiffy from a clean oilcan. Just cut off the spout to take the handle of a brush so that the bristles will not touch the bottom of the can when the spout is screwed in place. A little sealing wax applied at the point indicated will help make the container airtight. On some cans, it may be necessary to use a gasket under the spout rim.

—Sylvan Hass, Jr., Evansville, Ind.



Absorbent Ruffles Slip on Stems of Glassware



Cut from colored blotting paper, absorbent paper napkins or towels, these ruffles, which are slipped over the stems of glasses, help to protect table tops from beverage stains. If you desire the use of colored paper, first dip a sample in water to determine that the color will not run. Making the ruffles is a simple process and a large number can be cut out at once by

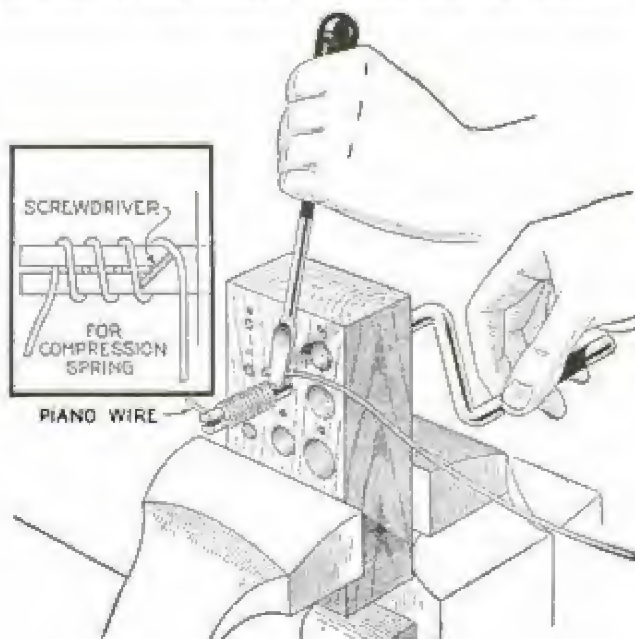
stacking paper and cutting through the pile with a razor blade as shown, the pattern being outlined on the top sheet. Cut a slit from the center hole to the edge to permit slipping the ruffles over the stems. Additional novelty and a personal touch can be had by initials or other means of decoration. The same idea also can be applied to coasters.—H. R. Wallin, New York.

Coil Springs of Many Sizes Quickly Formed in This Jig

Home mechanics or owners of small shops who have frequent occasion to wind small coil springs, will find this jig a time-

saver. A number of holes of different sizes are drilled in a hardwood block, and a drill-rod crank is provided to fit each hole. The cranks are slotted at the ends to grip the wire. In use, the block is clamped in a vise, after which a crank is selected, according to the size of spring desired, and is inserted in the corresponding size hole in the block. A screwdriver resting against a pin above the hole in the block is used to space the turns of wire as desired.

—Michael F. Wolf, Minneapolis, Minn.



❑ If you have an idea that might be used for a short article in these pages, send it to the Homecraft Editor. Inclose a snapshot or drawing and give all the necessary information in as few words as possible. To be accepted, material must be of general interest and different from any we have published previously.

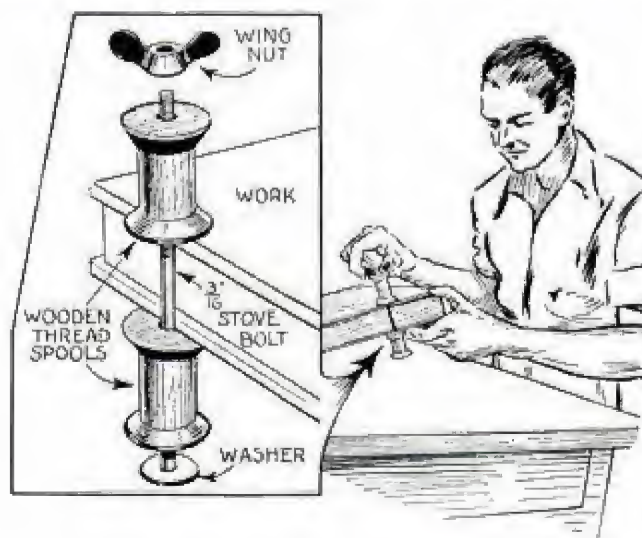
Bottom of Sticking Door 'Planed' with Altered Saw



To avoid removing a door to plane one or two spots on the bottom where it is dragging on the threshold, one workman uses a special saw. It is an old compass saw from which each alternate tooth has been filed or broken; the remaining teeth having been set to the left angle. By sliding this saw under the door, it may be operated to dress the door without making any marks on the threshold.

Clamp Improvised from a Bolt and Two Spools

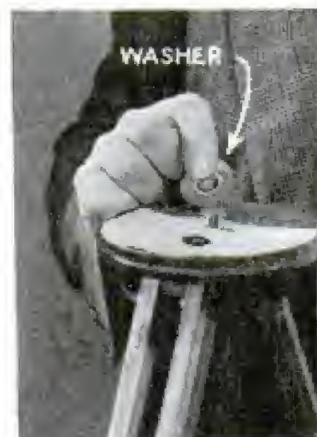
Especially useful for clamping small work at the edge and other places where the depth of reach is small, this little clamp will serve in an emergency. It is made by simply slipping a couple of empty thread



spools over the end of a stove bolt of suitable length. While a wrench can be employed to draw up the nut, a wing nut fitted in its place will be more convenient.

Panoraming with Any Tripod

Unless your tripod is especially built for panoraming of the camera, it is necessary to loosen the tripod screw to follow a fast-moving object. A better method is to slip a thin metal washer over the screw between the camera and tripod top. The camera then can be swung rapidly from side to side and remains securely fastened to the tripod.



Monkey Wrench Turns Pipe



In an emergency, a monkey wrench can be used to turn small pipe if a steel wood screw is inserted between the work and the lower jaw of the wrench. Also, this method may be used in loosening nuts that have their

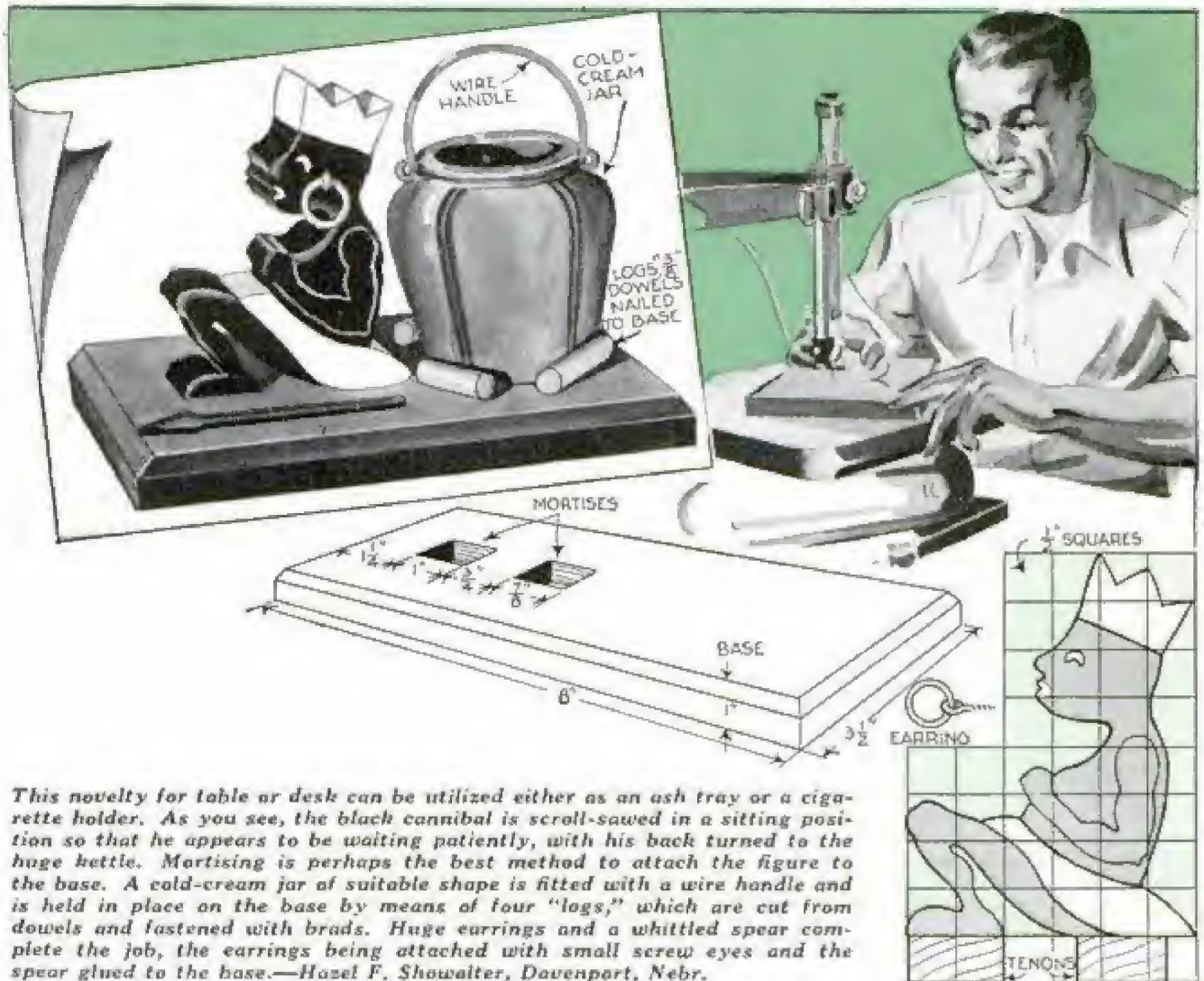
corners worn off so that the wrench will slip.—James Kawabata, Laramie, Wyo.

Rubber Side Pockets in Drawer Store Small Parts

Inner-tube sections having slits cut in them and nailed to the sides of shop drawers as indicated provide handy pockets for storing small tools. Also, the pockets are convenient for brads, nails, etc.

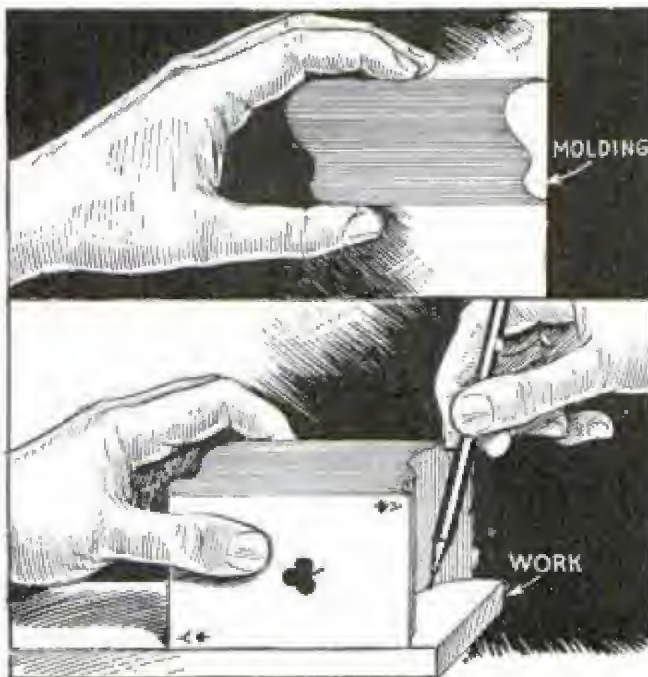


Cannibal King Guards Ash or Cigarette Tray



This novelty for table or desk can be utilized either as an ash tray or a cigarette holder. As you see, the black cannibal is scroll-sawed in a sitting position so that he appears to be waiting patiently, with his back turned to the huge kettle. Mortising is perhaps the best method to attach the figure to the base. A cold-cream jar of suitable shape is fitted with a wire handle and is held in place on the base by means of four "logs," which are cut from dowels and fastened with brads. Huge earrings and a whittled spear complete the job, the earrings being attached with small screw eyes and the spear glued to the base.—Hazel F. Showalter, Davenport, Nebr.

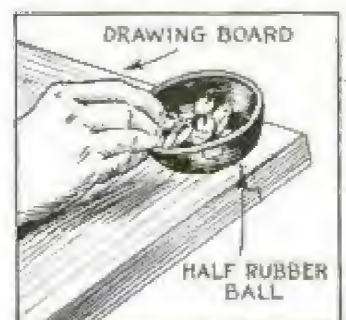
Playing Cards Serve as Template to Copy Irregular Work



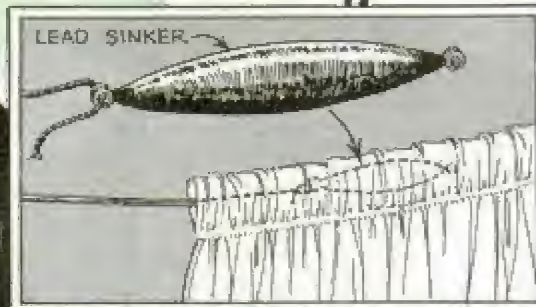
Accurate fittings for moldings, cornices, etc., can be cut by using two decks of playing cards to form a template of the work to be copied. Just stack the cards and then press one end over the contour of the work as shown. After squeezing the stack tightly to avoid slipping, remove it and trace the contour on the piece to be cut.

Tack Holder on Drawing Board

Half of a hollow rubber ball provides a handy thumbtack tray on a drawing board. Flexibility of the rubber makes it easy to select and remove the tacks.



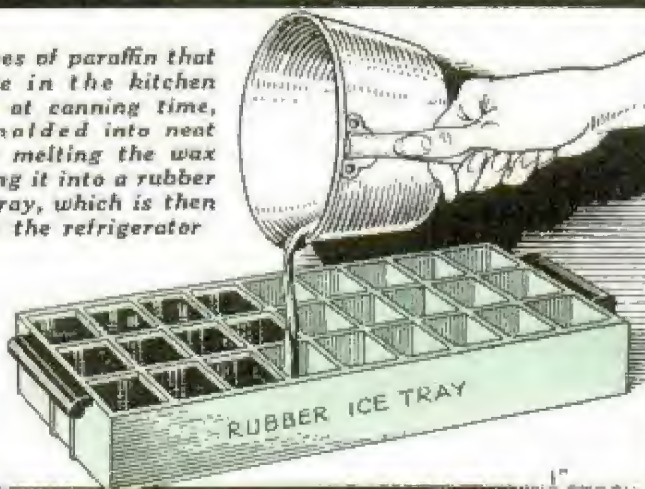
Solving HOME



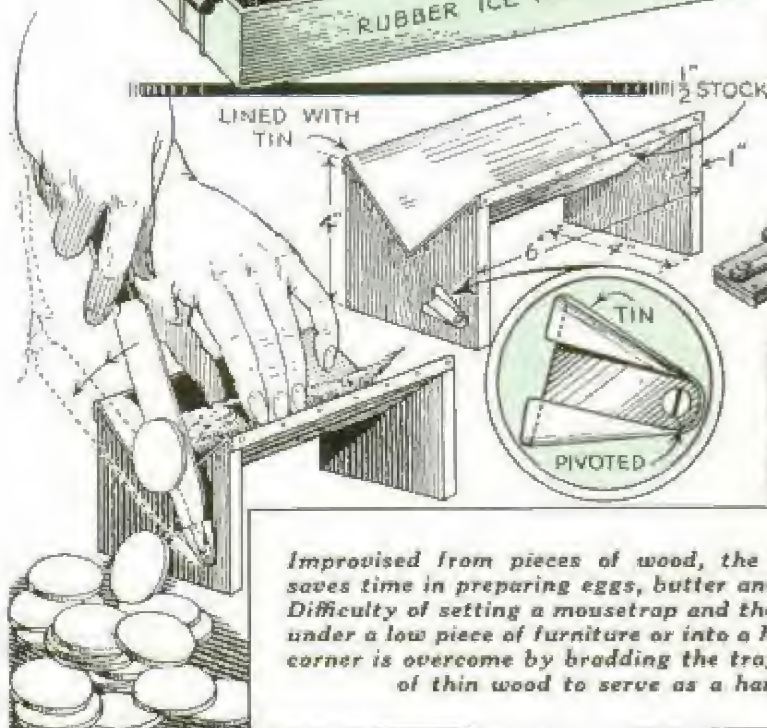
Threading a draw string through the hem of an apron, curtain or other article is no problem if you use a fishline sinker as a shuttle, which is forced through the hem by pressure of the thumb and index finger



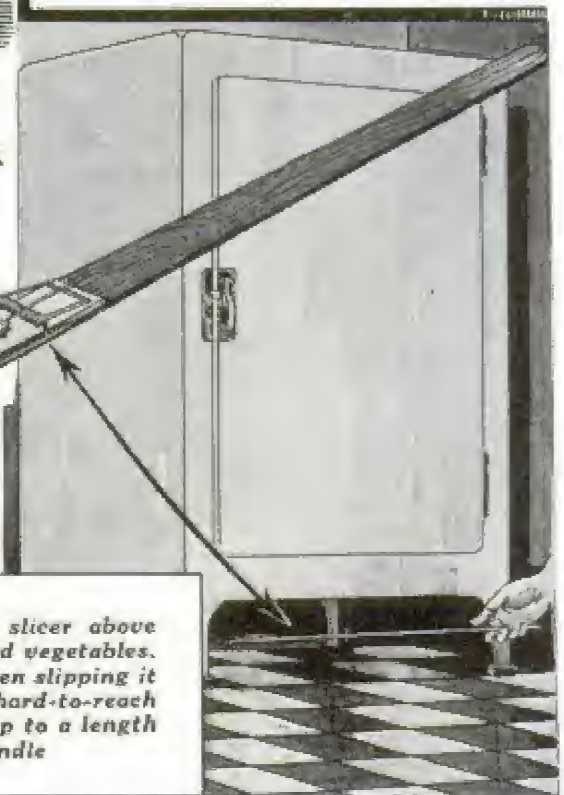
Scrap pieces of paraffin that accumulate in the kitchen especially at canning time, may be molded into neat blocks by melting the wax and pouring it into a rubber ice-cube tray, which is then placed in the refrigerator



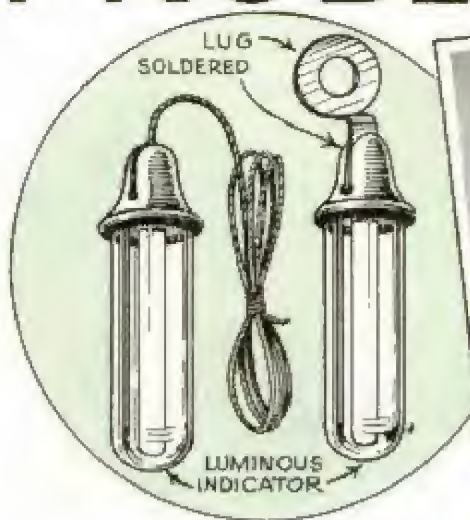
When using one yarn ball while working on a quilt, thread the yarn through the cloth and slip a cork with a slot in one side over the end so it can be tossed to each worker as desired



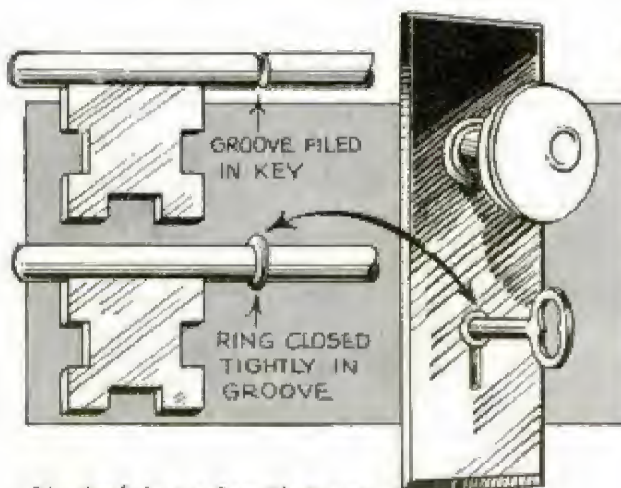
Improvised from pieces of wood, the slicer above saves time in preparing eggs, butter and vegetables. Difficulty of setting a mousetrap and then slipping it under a low piece of furniture or into a hard-to-reach corner is overcome by braddding the trap to a length of thin wood to serve as a handle



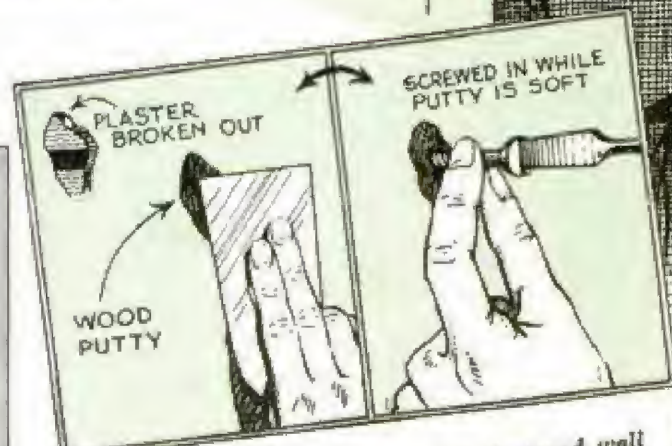
PROBLEMS



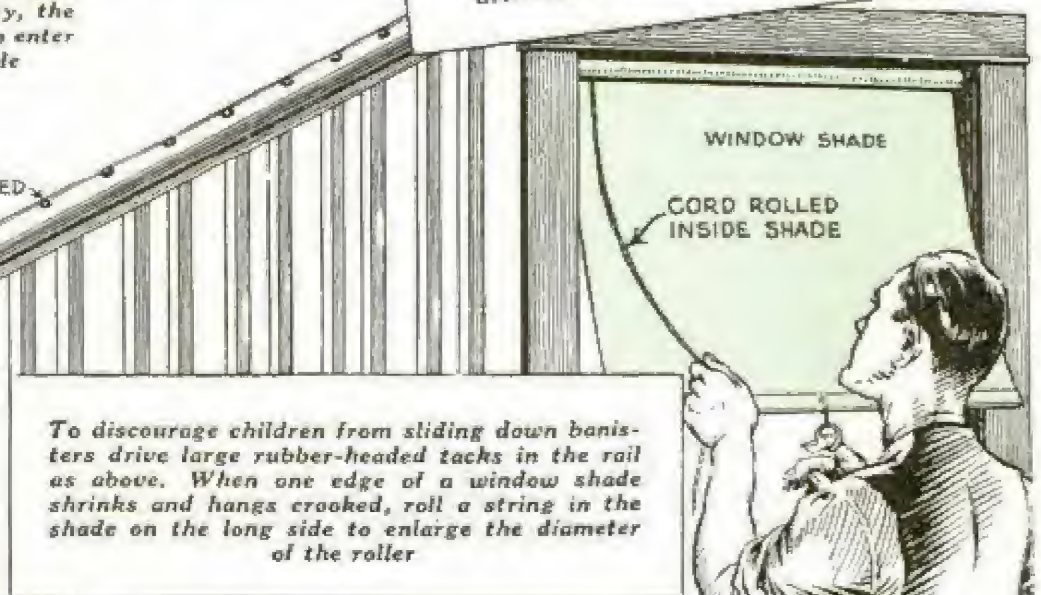
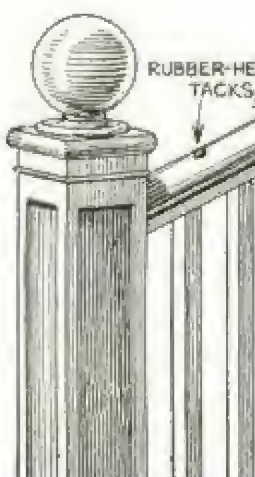
It's no trouble to find a wall switch in the dark if a luminous pennant is fastened to the switch plate as above. A brass eye or lug soldered to the upper end of the pennant slips under one of the plate screw heads



If a lock has a key that can be pushed clear through it, put a ring on the key, the ring being too large to enter the lock-plate hole

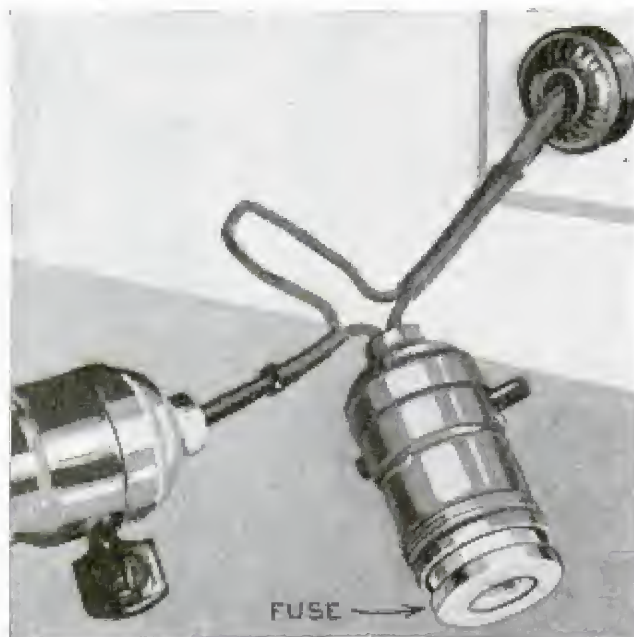


A screw will not pull out of a plastered wall if you first make a tiny opening, fill this with wood putty pressed tightly in place and then drive the screw while the putty is soft



To discourage children from sliding down banisters drive large rubber-headed tacks in the rail as above. When one edge of a window shade shrinks and hangs crooked, roll a string in the shade on the long side to enlarge the diameter of the roller

Simple Tester for Short Circuits



If a lamp or some appliance in the home is blowing fuses, you can make a tester to

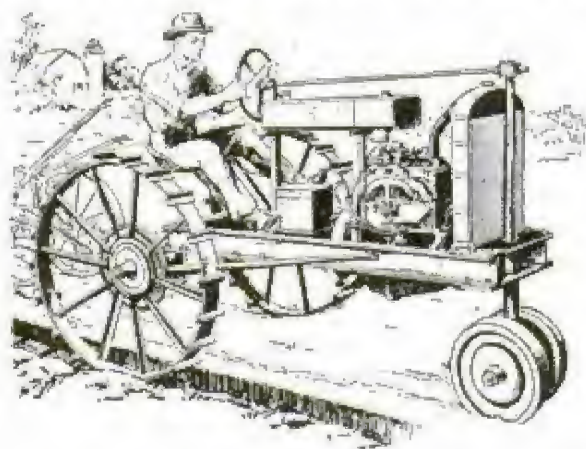
locate the trouble. Just take a short electric cord with a plug on one end and a socket on the other. Remove the insulation in the center and connect a socket containing a fuse to one of the wires. To use the tester, remove all appliance wires and then plug in the tester to each one in turn. When the faulty appliance is found the fuse in the tester will blow.

Medicine Dropper Spreads Glue

To aid in spreading glue, one mechanic bent a pipe cleaner and fitted it inside a medicine dropper. This ejects the glue as required to be spread by the cleaner.



How to Build a Farm Tractor in Spare Time



Having plenty of power to pull a two-bottom plow and other implements, this farm tractor, built from old car parts, includes a Ford model-A motor and twin transmissions giving six speeds forward. Wrenches, hacksaw and drill are about the only tools needed—welding can be done at your local machine shop. Set of three 17 by 22-in. plans, Nos. 1024 to 1026 incl., containing all necessary constructional details and a list of materials needed will be sent postpaid upon receipt of 75c.

OTHER BUILD-IT-YOURSELF PLANS

STREAMLINE FAMILY TRAILER—937 to 942: Includes all the conveniences of home with sleeping accommodations for four. Trailer is 15 ft. long and weighs approximately 1,400 lbs. Six prints \$1.00.

UTILITY TRAILERS—986 and 987: Built of old auto parts and lumber. Adaptations of body to suit various purposes. Two prints 50c.

ELECTRIC SPOT WELDER—891 and 892: Works on 110-volt, 60-cycle alternating current. For small work up to $\frac{1}{8}$ in. in thickness. Two prints 50c.

ELECTRIC ARC TORCH—1006: Carbon electrodes $\frac{1}{8}$ in. dia. produce arc for soldering, brazing, light welding. For 110-v. 60-cycle a.c. 25c.

SPEEDY BOBSLED—997: Box-type body gives rigidity and strength. Seat is 10 in. wide, 8 ft. 7 in. long, and accommodates six passengers. 25c.

COASTING TOBOGGAN—657: 7½ ft. long by 16 in. wide. Print shows how to make form to bend bottom slats. 25c.

HOW TO MAKE SKIS—569: Three types, 7 ft. long. Data on bending wood and ski sticks. 25c.

FRONT-STEERING ICE BOAT—786: 13-ft. cockpit. Single sail on 18-ft. mast. Safe. 25c.

18-FT. ICE BOAT—774: Roomy cockpit seats four people. 14-ft. mast, main sail and jib. 25c.

AIR-PROPELLED ICE BOAT—785: Motorcycle engine drives a 52-in. airplane propeller. 25c.

Any six of these plans (not projects) will be sent upon receipt of \$1

Address Plan Service, Popular Mechanics Magazine, 200 E. Ontario St., Chicago, Ill.



RADIO EQUIPMENT

for small craft

IMPROVED radiotelephone and direction-finding apparatus especially designed for pleasure craft, fishing boats and other small vessels, proved to be one of the popular radio exhibits at the New York world's fair.

The Federal Communications Commission permits the operation of marine radiotelephones under a third-class radiotelephone operator's license, for which it is necessary only to understand the simple routine of manual operation, and laws governing the use and courtesies of the air. No knowledge of telegraph codes is required.

The combination receiver and transmitter shown in photo (A) enables those on board a yacht or power boat



within the range of a coastal harbor radiotelephone station to have voice access to home or office, or any place that can be reached through available telephone systems. In emergency it

provides direct communication with the coast guard. Powered from any 12, 32 or 110-volt d.c. source, it consists of a 15-watt transmitter and a suitable all-wave receiver. The transmitting daylight range is upward of 50 miles, and the night range should be considerably greater. Direction finder (B) enables small boat owners to tune in any one of the many radio-beacon stations that dot our coast lines, and determine the position of the craft at all times. Receiver and adjustable loop are installed separately in any convenient location.



*Radiomarine Corp 75 South
Newark*

Beginner's

TWO-BAND

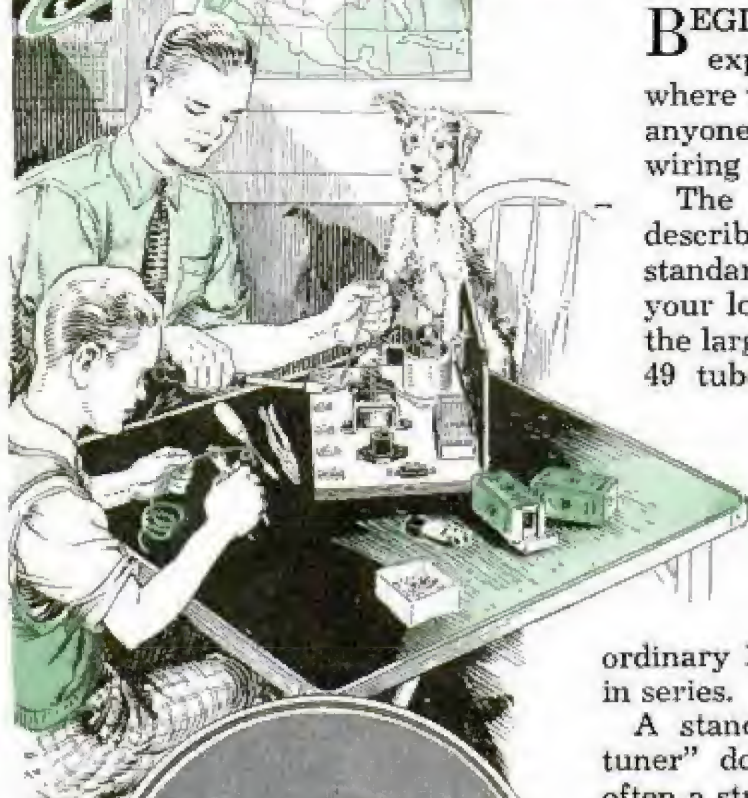


FIG. 2-B

BEGINNERS like to start with a small inexpensive "breadboard" type of receiver where the connections may be made easily by anyone who can use a soldering iron, as all wiring is in plain view.

The simple "flashlight-battery" set to be described is easy to build and uses low-cost standard parts that may be obtained from your local radio parts stores, or from any of the large radio mail-order houses. Two type-49 tubes, popular in flashlight-battery receivers previously described in Popular Mechanics Magazine, are employed. These dual-grid tubes, although designed to operate on a 2-volt d.c. filament supply, work nicely on a single 1½-volt dry-cell battery; the B-battery consists of 8

ordinary 1½-volt flashlight batteries connected in series.

A standard coil known as a "three-circuit tuner" does away with tedious coil winding, often a stumbling block for beginners. This coil comes fitted with a terminal strip marked for proper connections, thus reducing the possibility of wiring errors. It is supplied with a rotating "tickler" coil which makes it easy to control regeneration. Taps on the large coil provide a simple method for obtaining short-wave reception in addition to the regular broadcast band. Change-over from one band to the other is made by merely flipping a toggle switch. The extended short-wave band includes most of the police radio stations, the 160-meter amateur phone stations, and 80-meter C.W. (code) stations.

Wood base and pressed wood panel are detailed in Fig. 1. The metal coil shield will be held firmly against the front panel

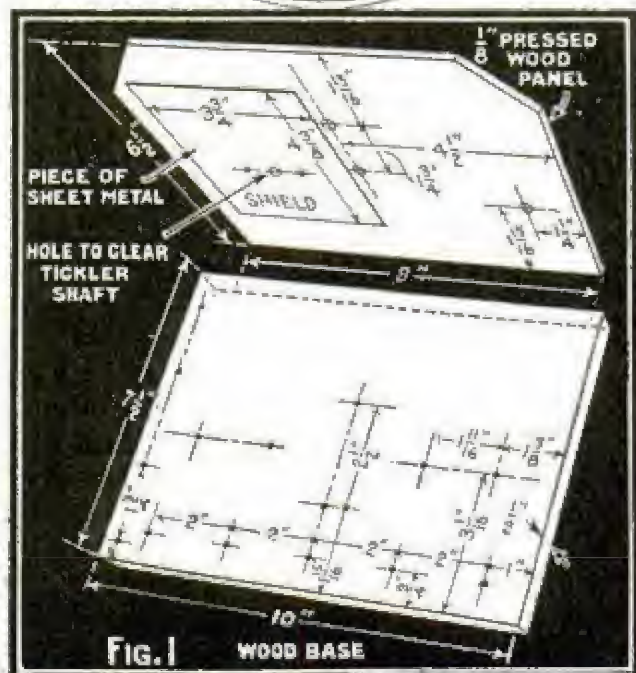


FIG. 1 WOOD BASE

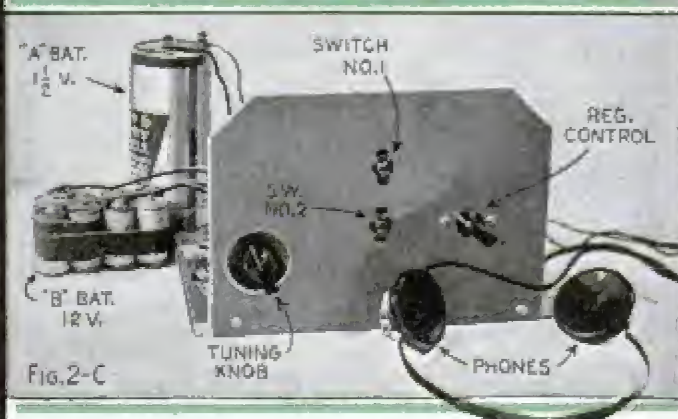


FIG. 2-C

Flashlight-Battery SET

by means of the mounting screws that bolt the 3-circuit tuning unit to the panel, as indicated in the simplified wiring diagram Fig. 2 and photos 2-D and 2-E. Mount the variable condenser on the baseboard by means of a long machine screw, the head of which is countersunk in the wood on the under side. Tube sockets, 3 to 1 ratio audio transformer and clips on the baseboard are fastened down with wood screws. The bottom of the coil should be cemented to the board with china cement. Make all connections exactly as shown in Fig. 2. A schematic circuit diagram appears in Fig. 3.

Complete battery hook-up is shown in Fig. 2-A; when soldering the leads on the B-batteries, scrape the area very carefully on which the solder is to flow, use rosin-core solder and make all soldered connections neat and firm. The flashlight cells are taped together with the positive and negative ends arranged as shown in photo Fig. 2-B.

Please note that the connections to the stationary plates (S) on the variable condenser C_1 are made on both sides of the condenser, as these (S) lugs on the stationary plate section are common. The lug (R) which is mounted directly on the frame

(Continued to page 132A)

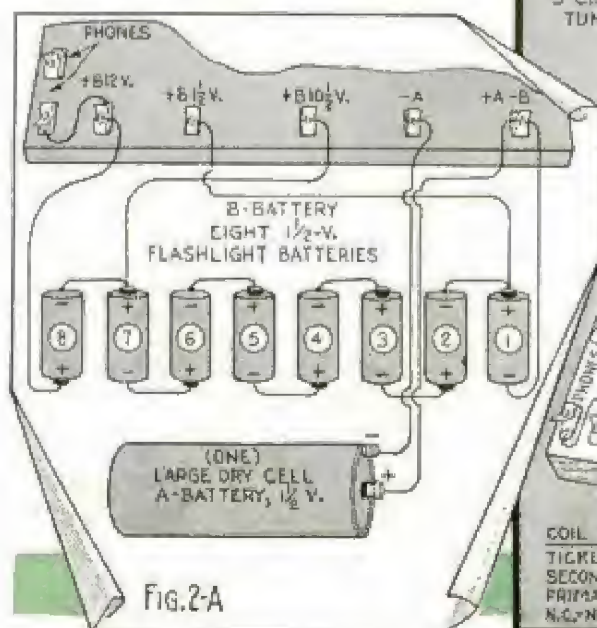


FIG. 2-A

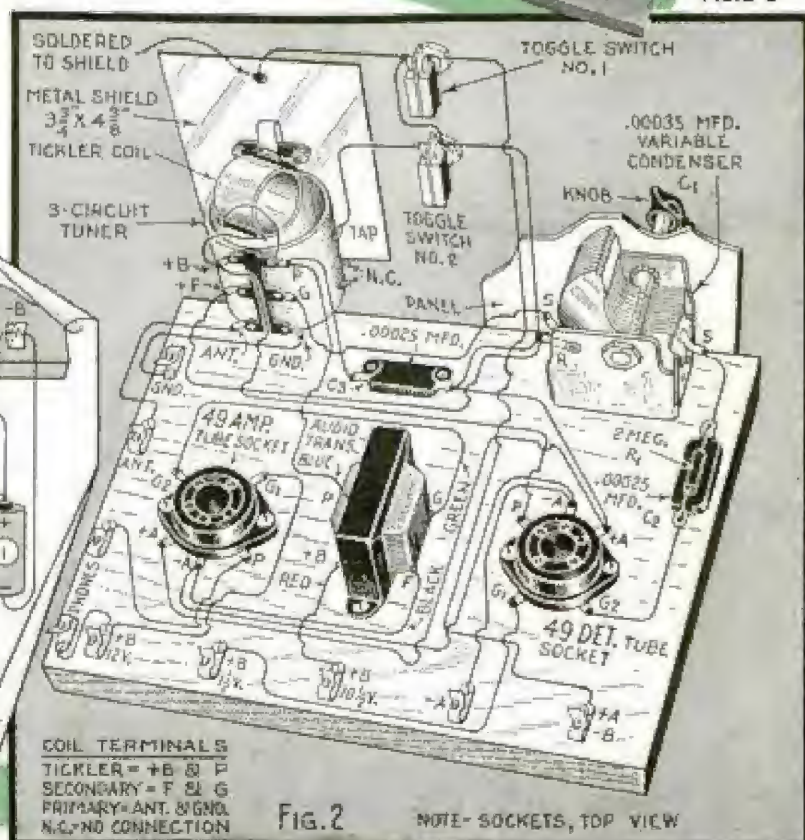


FIG. 2

NOTE- SOCKETS, TOP VIEW

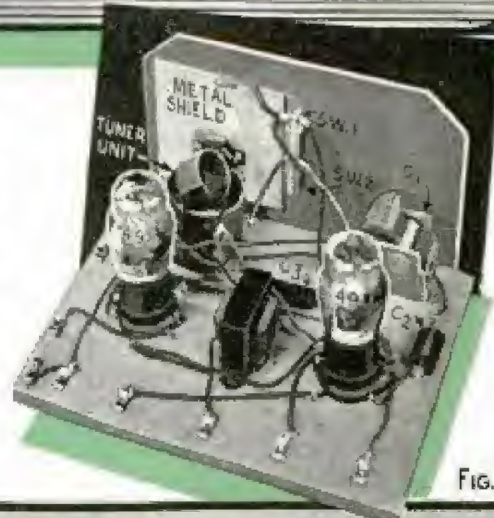


FIG. 2-D

new players. R.C.A. my 6 Camden. N.Y. 23 w. each
recording unit - Speak. O. Phon. 23 w. each



Parts of this description are shown in the accompanying photos, Figs. 2, 3, and 4; two variations of the completed recording

(Continued to page 134A)

Practical RADIO HINTS

Soldering paste is always at hand when kept inside your spool of wire solder, as shown in Fig. 1. The small soldering iron illustrated in Fig. 2 is designed for working on midget receivers; note cooling flanges that protect the handle

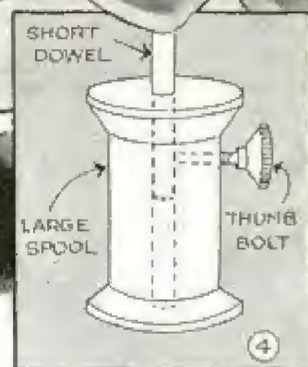
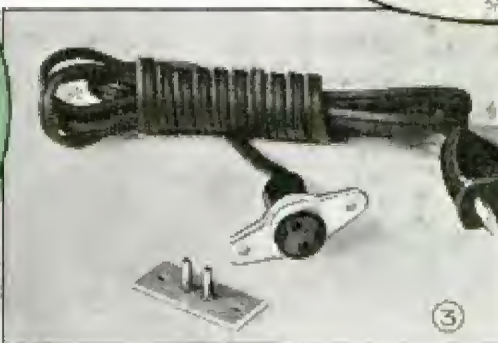
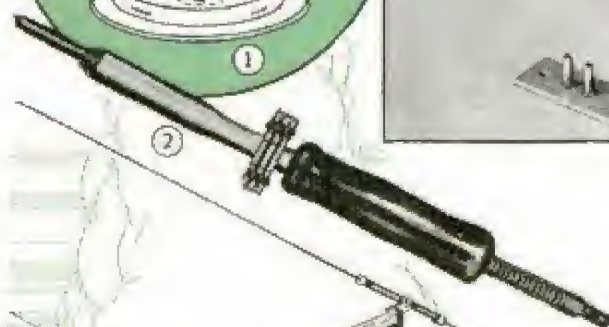
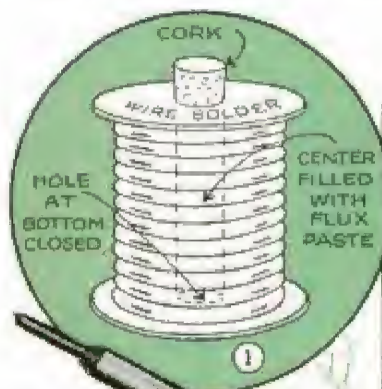
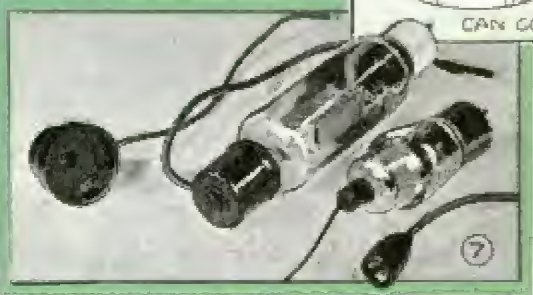
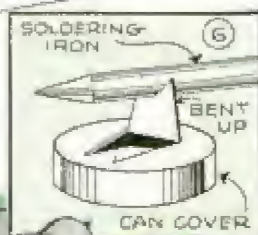


Photo Fig. 3, compact outlet for set chassis, to operate a lamp or record player

Fig. 4, adjustable "spool jacks," easily made from junk-box materials, provide excellent supports for a radio receiver or amplifier chassis on the workbench while testing or repairing. Several of these spool jacks placed at convenient points under the chassis as illustrated in the sketch above, hold the instrument upside-down without damage to tubes, coils or other parts mounted on top of the base. Photo and sketch, Fig. 5, show a television antenna-kit assembly with universal mounting joint which permits adjustments in all directions; the di-pole antenna rods are made of heavy duralumin held together with a sturdy center insulator. Fig. 6, non-tipping stand for soldering iron, improvised by cutting a can cover as shown

Fig. 7, insulated tube caps now available for protecting amateurs, experimenters and servicemen when working on television receivers, amplifiers and transmitters that employ high-voltage tubes



Reading Lamp and Radio Set



This 5-tube receiver, with high-power tubular-type lamp built in, clamps on head of bed within easy reach for tuning. No antenna or ground wire is required.

Toy Phonograph Is Motor Driven

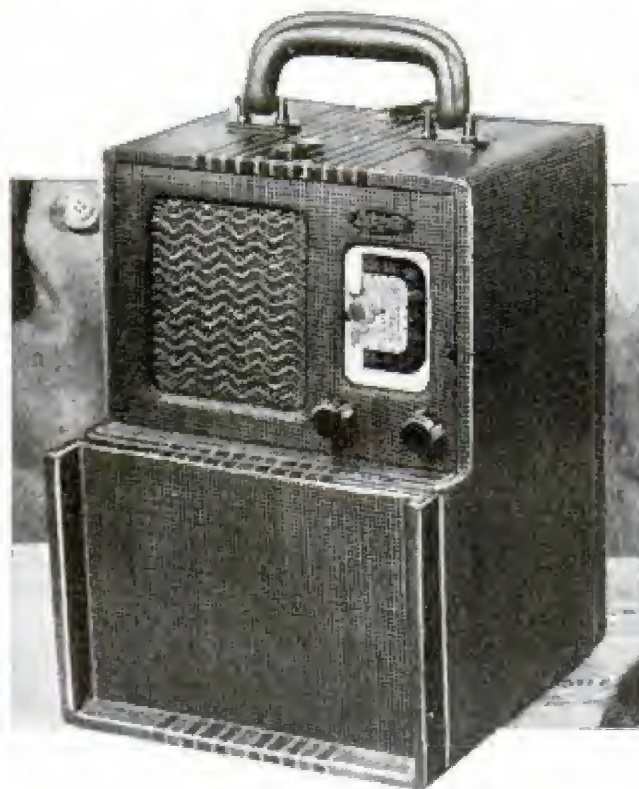
A cone speaker is built into the streamline tone arm of this junior electric phonograph which plays records of all sizes up



to 12 inches. Specially designed to stand up under the "hard knocks" of playroom games, it has an electrically driven turntable mounted in a cabinet of molded plastic. Easily operated by youngsters, this tiny phonograph is one of a series of practical educational toys.

Five-Tube "3 in 1" Portable

Entirely enclosed in a case of airplane luggage material, and available in several designs planned for easy portability, this little set works from 110-volt a.c. or d.c.



light lines in the home. On camping trips or picnics, it supplies its own power from small self-contained batteries. A built-in loop antenna eliminates all external wires.

☐ Blueprints covering radio construction articles in this and past issues are available for 25 cents each. Original material lists, with names of manufacturers and dealers, can be obtained from our Radio Department upon receipt of postage.

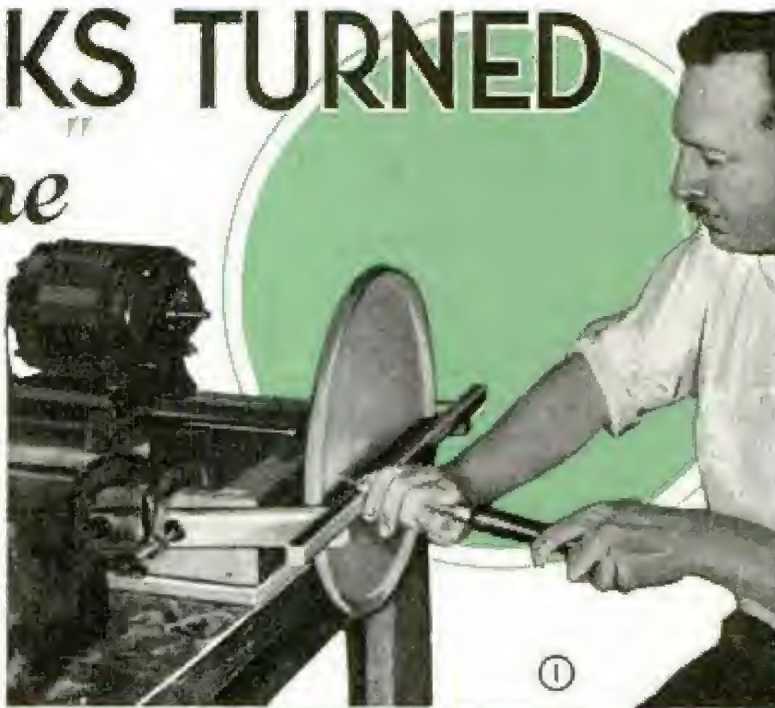
NEXT MONTH—How to Build the Little Giant Push-Button A.C.-D.C. Four-Tuber. This 1940 improved model of the popular low-cost midget broadcast receiver uses new tubes that eliminate line resistor, and also employs a practical method of mechanical push-button tuning. Also—**Compact Photocell-Operated Relay**



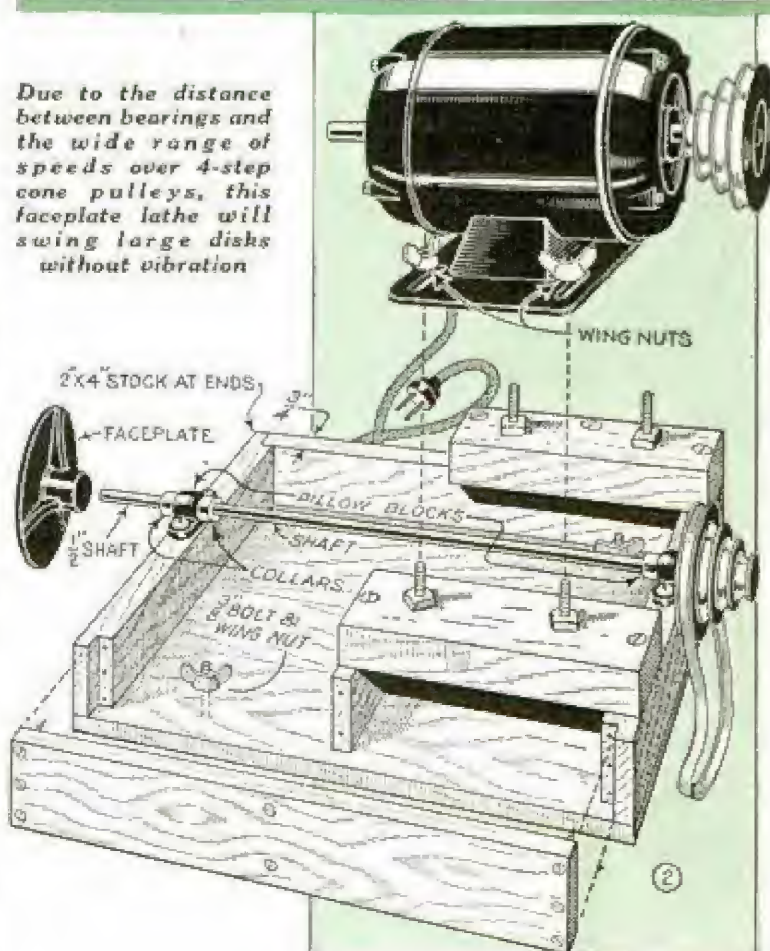
SHOP NOTES

LARGE DISKS TURNED on this "lathe"

OF COURSE, this isn't really a lathe at all. It's merely an improvised headstock and about all the materials you need to make it are a length of $\frac{1}{2}$ -in. shafting, two suitable bearings, and a few short pieces of pine stock which you likely will have right at hand. So simple is the construction that you can have the whole thing set up ready for work in a few minutes. Figs. 1 and 3 show how it works, while Fig. 2 gives the details. No over-all sizes are indicated because the headstock base must be made to suit the motor you have and also the diameter of the disks to be turned. For average work the base should be about 28 in. square, which will allow the headstock to swing disks up to 25 in. in diameter. This means that the $\frac{1}{2}$ -in. shaft will have to be approximately 32 in. long to allow projections beyond the bearings for the step pulley and faceplate. The base for the motor can be built up of blocks and two cross members as indicated in Fig. 2. Most anything will do so long as it is solid and places the motor in the proper position, which is above and slightly to one side of the shaft. Its exact location will have to be determined by the length of the drive belt. Of course, the slots in the motor base will give sufficient



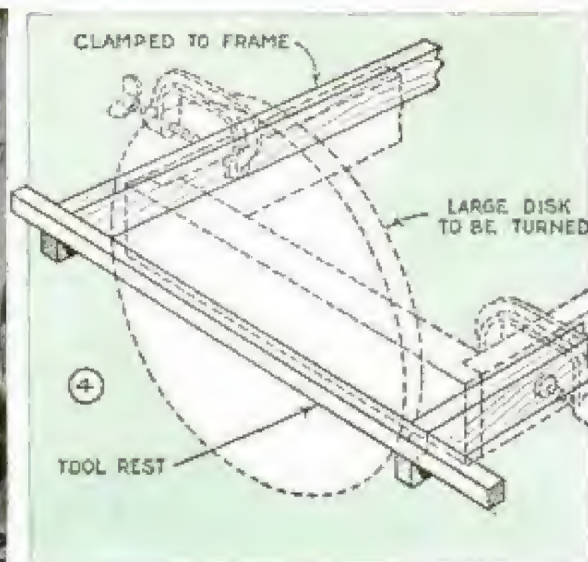
Due to the distance between bearings and the wide range of speeds over 4-step cone pulleys, this faceplate lathe will swing large disks without vibration





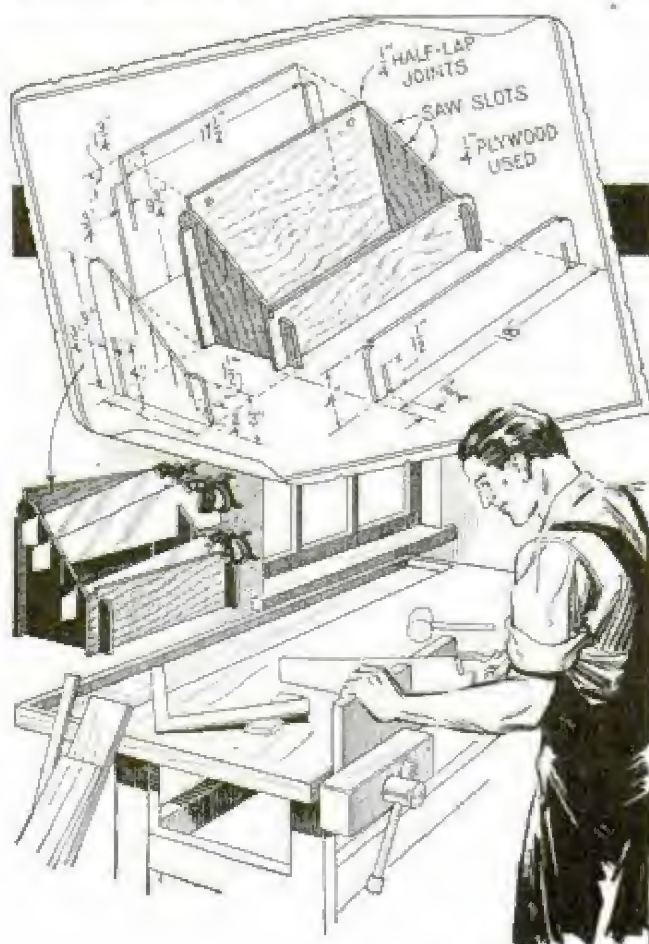
adjustment for tensioning the belt once you have the motor located. Note that nuts are run down over the bolts holding the motor. The base of the latter rests on these, and additional wing nuts are used to tighten the motor in place. This arrangement makes it easy to remove when needed for other work.

Brass one-piece pillow blocks serve as bearings for the shaft. These are fastened



with heavy wood screws. Three collars prevent undue end play in the shaft and take the thrust of turning. The tool rest, Fig. 4, is made of three pieces of hardwood and clamped to the base as shown. It can be adjusted easily to the size of any disk that is being turned. Use an ordinary lathe faceplate of the type which locks to the shaft with a headless set screw. In use the lathe is clamped or bolted to a solid bench.

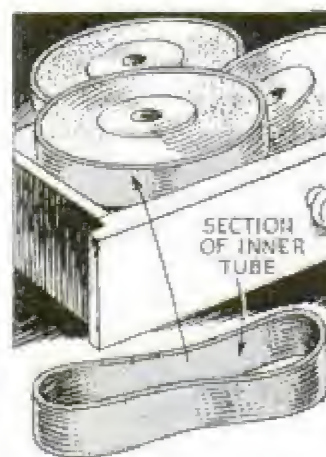
Handsaws within Easy Reach in Rack over the Bench



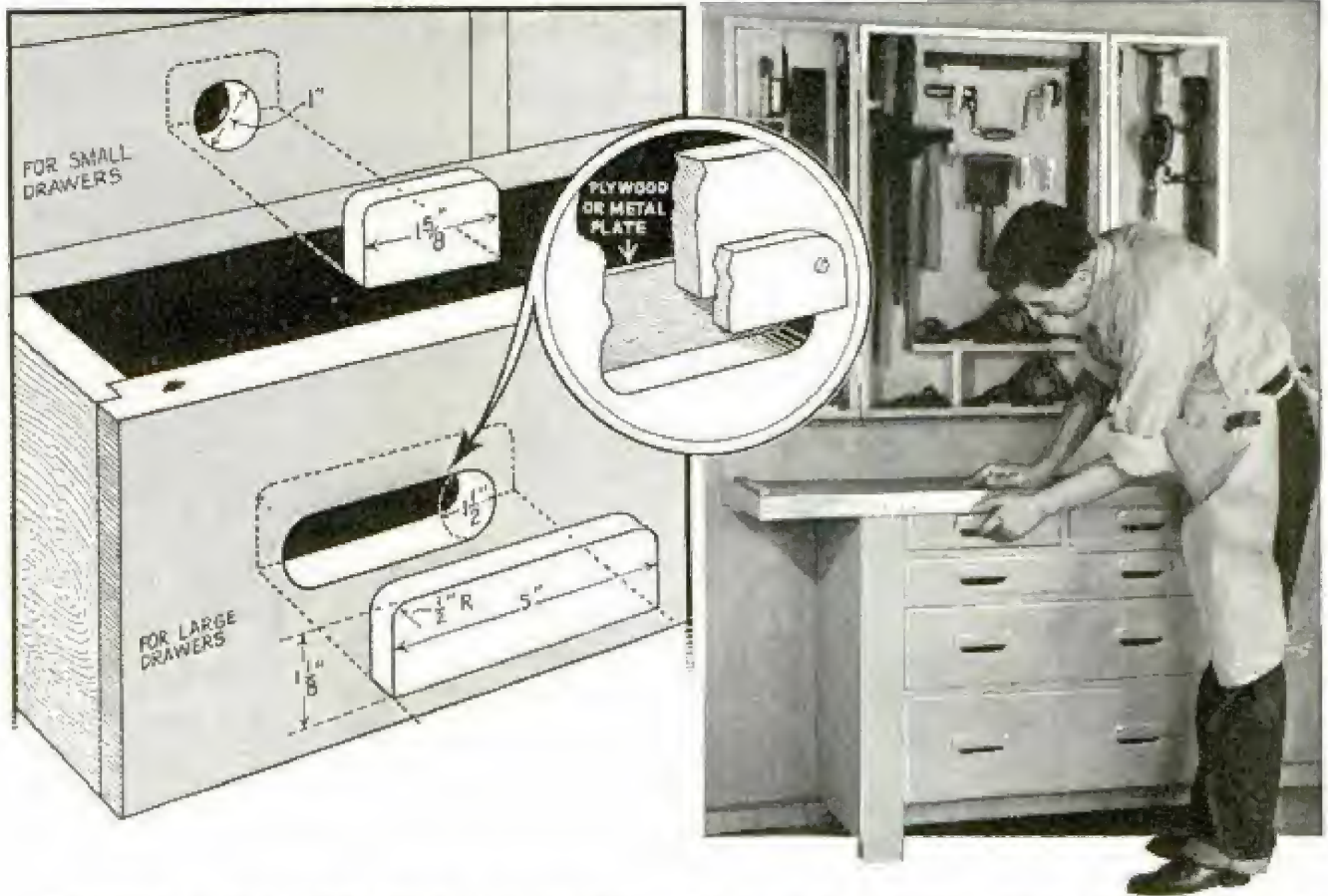
Designed to accommodate several handsaws of various lengths, this handy wall rack, which can be hung in any convenient location over or near your bench, simply fits together without the use of nails or screws. It is cut from $\frac{1}{4}$ -in. plywood and is assembled by slipping the parts together, which is made easy by half-lap joints. Vertical slots are cut in the end pieces.

Grinding Wheels Have "Tires" to Protect Edges

A craftsman who has several grinding wheels on hand protects the edges by slipping a wide rubber band around the wheels. The bands can be cut from an old inner tube. Be sure that they are wide enough to fold over the edges.



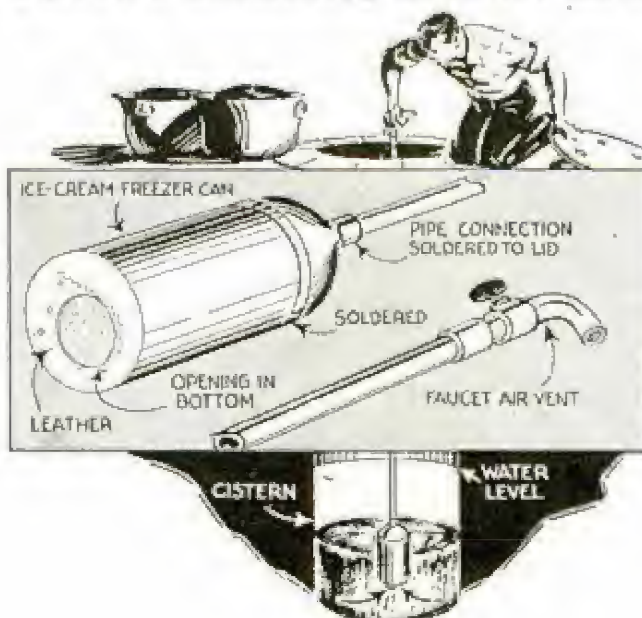
Shop Cabinets Fitted with Flat Drawer Pulls



Drawers in workbenches and shop cabinets can be equipped with pulls that project only $\frac{1}{4}$ in. beyond the fronts. If a drawer is large and heavy, a handhole large enough to admit three or four fingers is cut slightly above the center of the drawer front by boring and sawing out the wood. For a small, light drawer, a single

hole to admit one finger is usually sufficient. The edges of the hole are rounded and a piece of $\frac{1}{4}$ -in. plywood is glued and bradded—or screwed if necessary—half-way over the hole. If you desire, a strip of sheet metal or thin wood can be applied to the inside of the drawer front to close the hole.—E. M. Love, Monterey Park, Calif.

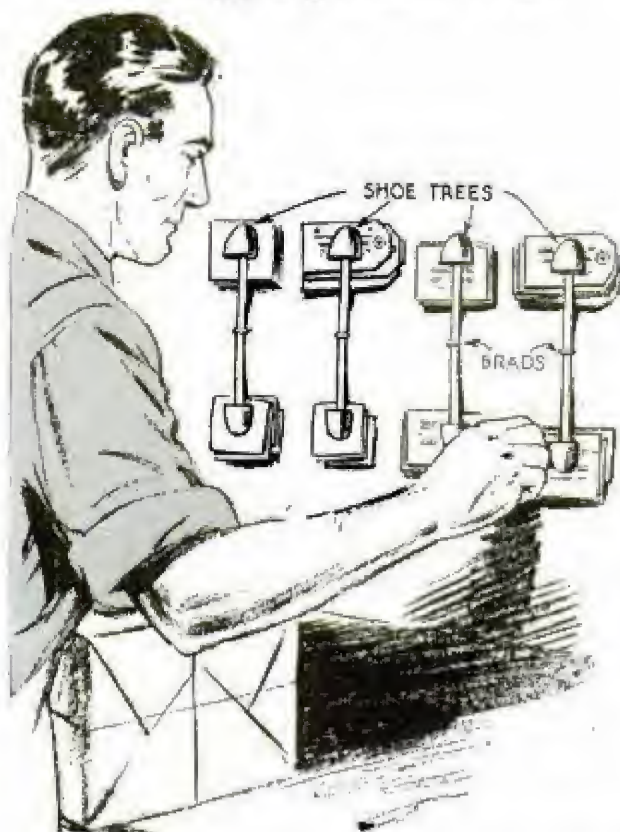
Cistern-Cleaning Bucket Excludes Water but Admits Mud



There's no need to drain or pump water out of a cistern if you use this bucket. An ice-cream freezer can, some pipe and a faucet is about all you need to make it. A hole is cut in the bottom of the can and is fitted with a leather valve. The cover is soldered in place and a pipe flange is soldered over a small hole in the cover, after which the pipe and faucet are added. Air trapped inside the can prevents entrance of water while being submerged. When the can is pushed against the mud, the faucet is opened to release air while the mud enters. The leather valve prevents mud from dropping out while the can is raised to the top, where it is emptied.

—Geo. W. Bucklin, Lincoln, Nebr.

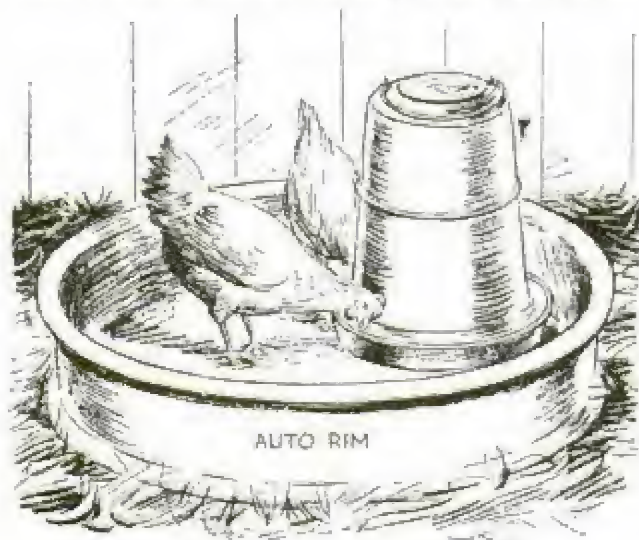
Shoe Trees Serve as Tag Holders on Shipping Room Wall



Fastened to a wall with brads or staples as shown, inexpensive shoe trees provide handy holders for tags, labels, etc., which are slipped under the ends of the trees. Numbers or letters can be painted on the ends of the trees to designate the tags or papers under them.

Poultry Fountain inside Auto Rim Does Not Collect Chaff

Large auto-wheel rims placed around poultry water fountains as shown will prevent fowls from scratching chaff and litter



into the water. The rim also prevents water being splashed into chaff and straw on the poultry-house floor.

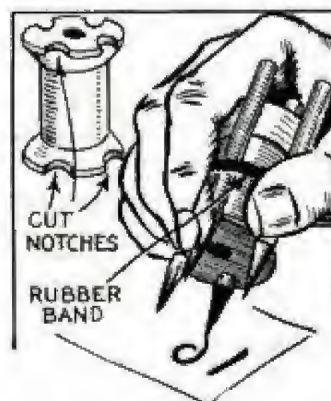
Hinged Windows Held at Angle by Perforated Metal Strip

Needing a method of adjusting his poultry-house windows, one farmer did it inexpensively by using strips of perforated flat iron, such as pipe straps. One end of



each piece is pivoted to the window casing by means of an angle bracket and a small bolt. A short pin in the sash slips into one of the perforations to hold the window.

Clerk's Multiple "Pencil" Writes in Four Colors

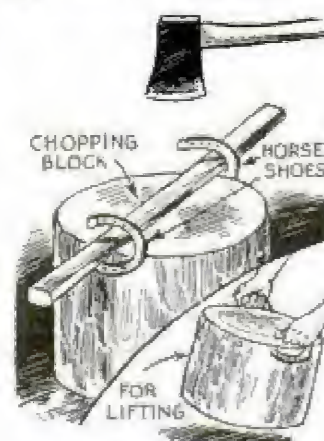


One shipping clerk who had to put identification marks with colored crayons on packages, clipped four of them to an empty thread spool, which served as a pencil with different colored leads. Ends

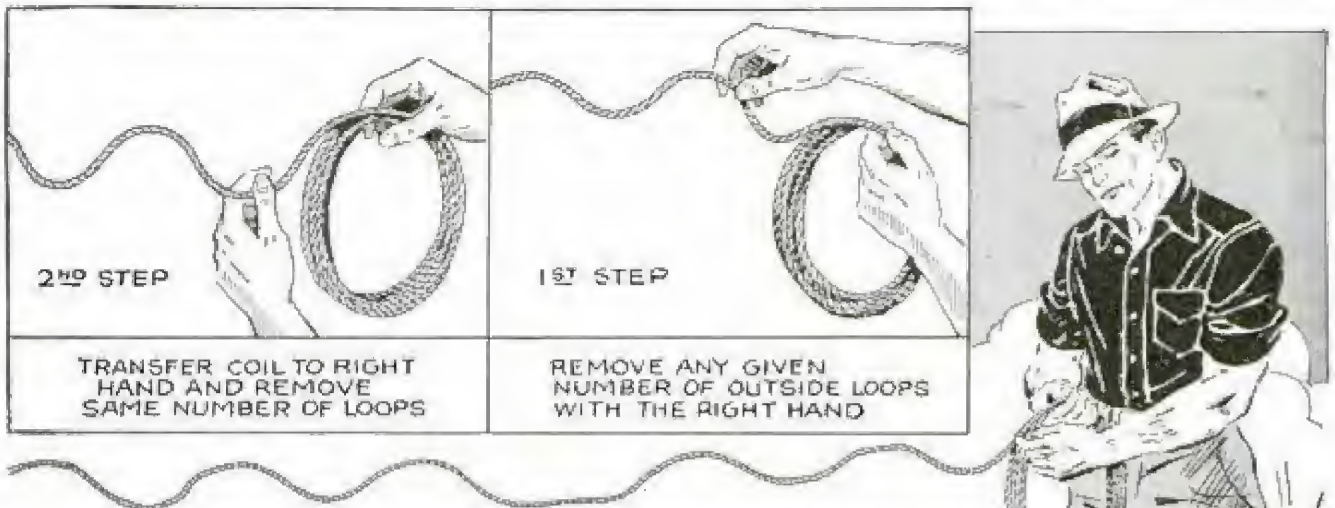
of the spool were notched and crayons were held in place with a rubber band.

Horseshoes on Chopping Block Keep Kindling from Flying

To prevent pieces from flying when chopping kindling, a farmer attached a pair of horseshoes to the sides of the chopping block. Nailed securely in place, the shoes also serve as handles to move the block.



Trick in Uncoiling Wire Cable Avoids Kinks

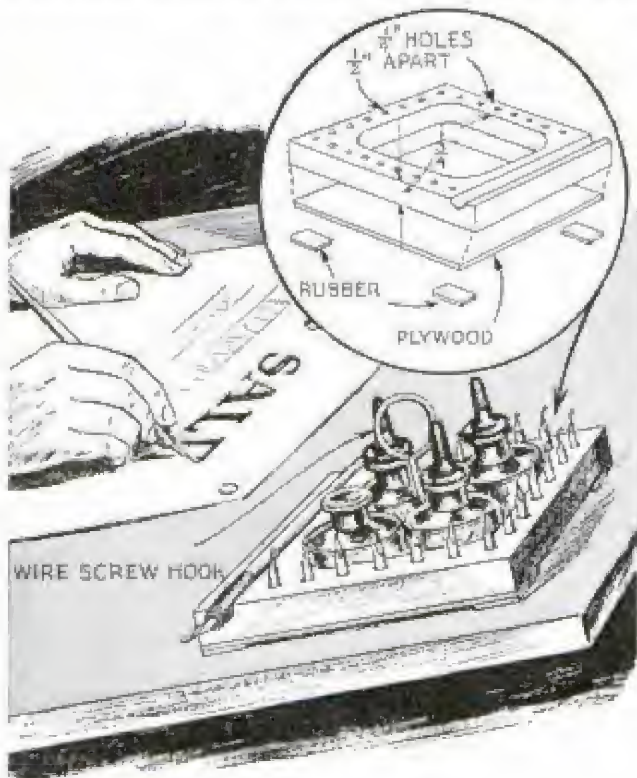


OPERATION REPEATED UNTIL DESIRED AMOUNT IS UNCOILED

Unless you practice a simple trick you are likely to have trouble uncoiling wire or cable, especially the latter. The difficulty is the persistent tendency of the wire or cable to kink. Straightening one kinked section only forms another somewhere else along the length. It takes but a few minutes of this to get the whole thing into an impossible snarl. To avoid this, grasp the coil in the left hand and remove a number of loops with the right as shown above. Then shift the coil to the right hand and remove the same number of loops with the left. Continue this method until enough cable or wire is removed.

—A. E. Rutkowsky, Freedom, Pa.

Artist's Ink and Pens Are Handy in Neat, Portable Holder



Artists, show-card writers and others doing similar work, will find this holder convenient. It has a well for ink bottles, a place for pencils and a number of holes to take lettering pen points. The whole unit may be picked up by its convenient handle and moved or carried about. Small rubber feet keep it from sliding on a tilted board or table. It is cut from $\frac{3}{4}$ -in. stock and is fitted with a thin plywood bottom.

—M. G. Winterton, Ft. Lewis, Wash.

Handling Photo Film and Paper

The inconvenience in a busy studio darkroom of handling photographic film and paper by the edges to prevent damaging them with the fingers can be avoided by using a couple of fingers cut from a rubber or leather glove. Wear the fingers when handling paper and film and there will be little possibility of damaging them.

Novel Fruit Display Simulates Miniature Volcano



Red-paper streamers waving upward from the center of a conical pile of fresh fruits give this display an unusual animated effect. The fruit is piled around a length of stovepipe, which has a small electric fan in the bottom to force a blast of air up against the streamers of red crepe paper. These are fastened around the inside surface of the pipe at the top.

Sheet-Metal Worker Uses Mallet to Move Flat Pieces

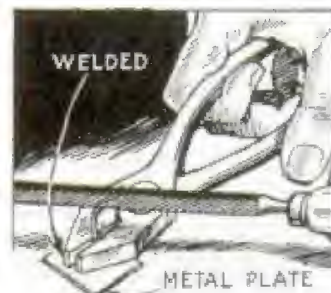
Thin sheets of tin and sheet iron are hard to move with the fingers on smooth surfaces and layout plates. Also, it is difficult



to set them accurately under the blade of foot shears. However, this trouble can be avoided if rubber-head tacks are driven in the side of the worker's mallet. A light pressure of the mallet head on the smaller sheets and strips makes it possible to move and place them easily.

Pair of Pliers Has Plate on Jaw to Help Hold Small Work

You will find a metal plate welded to one jaw of a pair of pliers helpful in holding a small article while working on it. The plate prevents the work from dropping out of the jaws if the grip on the handles is momentarily loosened.



This Stretcher Pulls Long Fence without Resetting Claws



Tightening long lines of fence wire is no job with this stretcher. The long handle gives plenty of leverage so that one man can operate it easily. Made of $\frac{1}{4}$ by $1\frac{1}{2}$ -in. flat iron, the stretcher is assembled as shown. The chain on which the claws operate can be of any length desired, depending on the wire to be tightened.

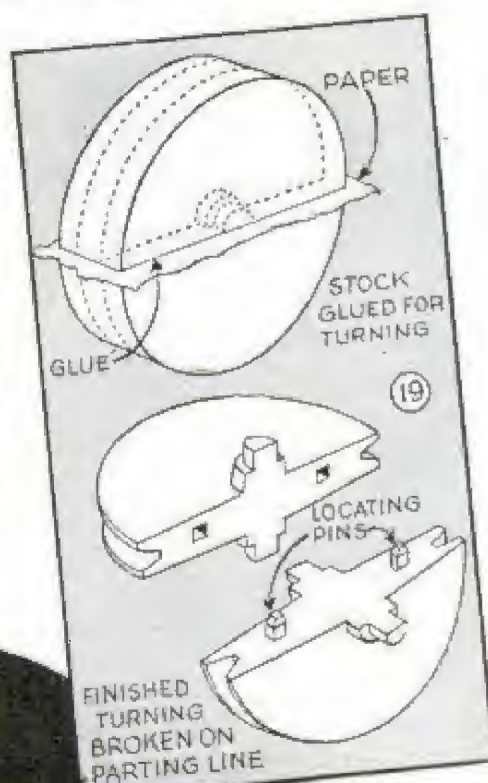
—Wilmon Mayeaux, Cottonport, La.

from PATTERN to CASTING

PART II

Two-Piece Patterns and Cores

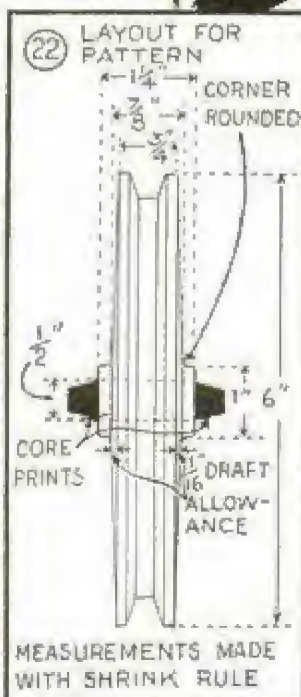
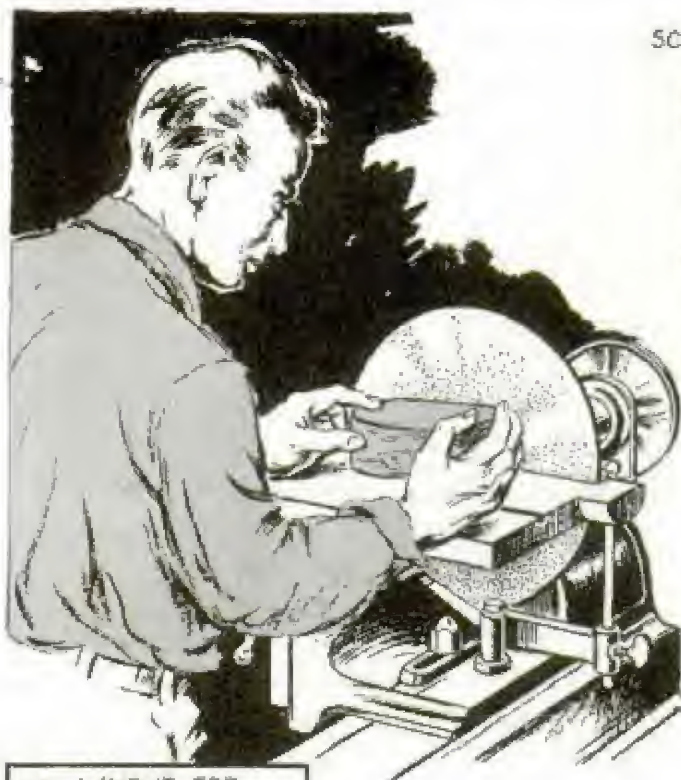
WHERE the pattern must be of such shape that it cannot be made with the draft running in one direction from the parting line, it is necessary to resort to a split pattern of two or more pieces. As an example of this type of pattern, take the small V-pulley shown in Fig. 19. As you will see this pulley has no recessed web or spokes, so it can be cast in the vertical position as in Fig. 20. The parting line in this case will be on the diameter of the pulley. The curvature of the wheel and the V-shape of the belt groove will provide sufficient draft on these surfaces. However, the flat outside surfaces will require draft. Keep in mind that the amount of draft will be not less than



$\frac{1}{8}$ in. to the foot for that part of the pattern below the parting line, while on the half of the pattern above the parting line (the cope section) the draft should be twice as great, or not less than $\frac{1}{4}$ in. per foot. This permits easy parting of the cope and drag when the mold has been completed.

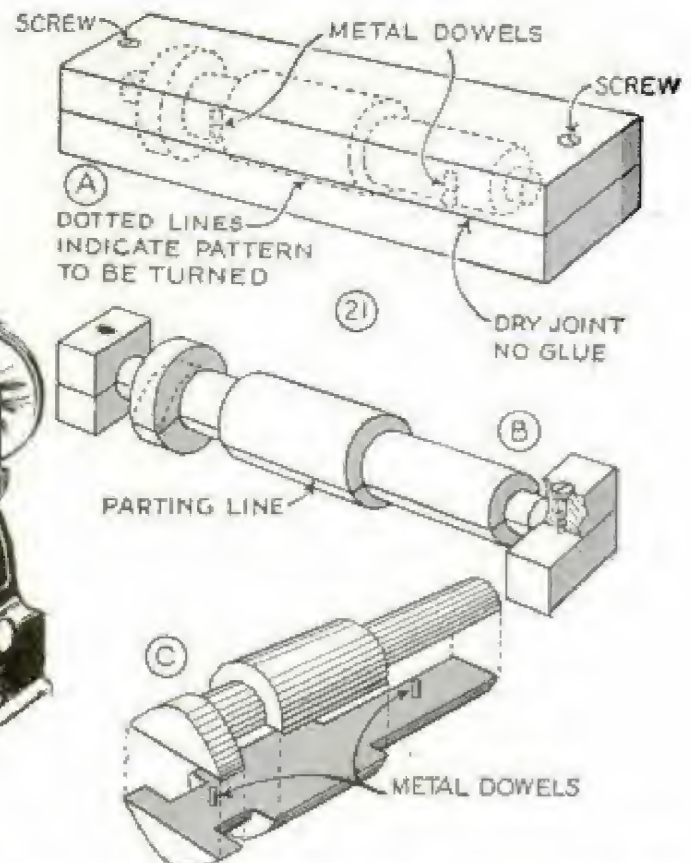
The layout of this pattern is made as shown in Fig. 22, and the method of turning it complete in the lathe is detailed in Figs. 23 to 26 inclusive. Irregular-shaped patterns are usually made with ordinary hand tools and carving chisels. In almost all cases of split patterns, it is best to make the pattern out of two pieces of clear white pine, the joint between the two parts corresponding to the parting line. If these two pieces are joined together with staples, corrugated fasteners or screws in Fig. 21 A, B and C, the pattern can be turned or





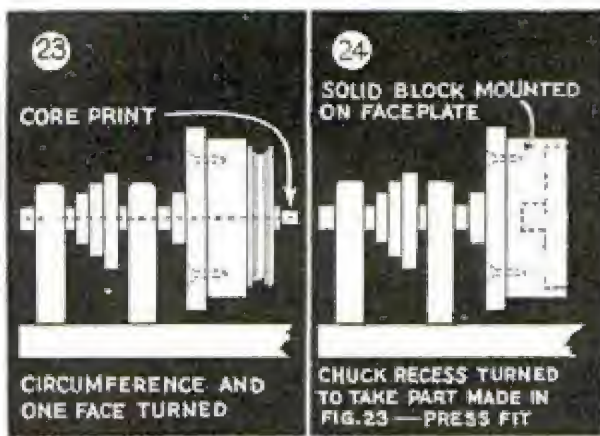
otherwise shaped as though it were in one piece. In those cases where it is not possible to locate staples or screws so that they will hold the parts together, the blocks can be joined by gluing with a sheet of newspaper between as in Fig. 19. This will give a good bond which can be broken easily when the job is completed without damage to the parts.

Before completing the V-pulley pattern you come to the matter of cores. Where a hole through the casting is required to have straight sides (without draft), or where it must be in such a position that it cannot be formed as a part of the pattern, the hole must be made by coring. In the case of this pulley the hole required for the shaft not only must be cylindrical, but it also would be impossible to form it with the pattern alone. For this reason it must be cored. Note the core prints in Figs. 19 and 22. These are simply projections from



the pattern which form openings in the mold by which the core is supported as in Fig. 30. In regular practice core prints are usually tapered slightly, but in individual work where pattern and core are used only once or at most, a few times, this is seldom necessary. In small work especially, they can be the same diameter as the core and, of course, should be in direct line with the core. Usually the combined length of the core prints should equal at least half the length of the cored hole for proper support. The core prints can be either integral parts of the pattern, or separate turned pieces fastened to the main pattern with screws or dowel pins. In this particular case it will be easier to make them as part of the pattern.

Dry-sand cores are usually made in a core box of the proper shape and then baked dry. A simple core box can be made by inserting locating dowels in two pieces of white pine as in Fig. 27. Cut the pieces to such length as you want the core, then staple them together and drill the blank lengthwise, as in Fig. 28. The two halves are then separated as in Fig. 29, and the surfaces lightly sandpapered and shellacked all over. If the core is not cylindrical or if its cross-section is not constant throughout the length, hand work will be

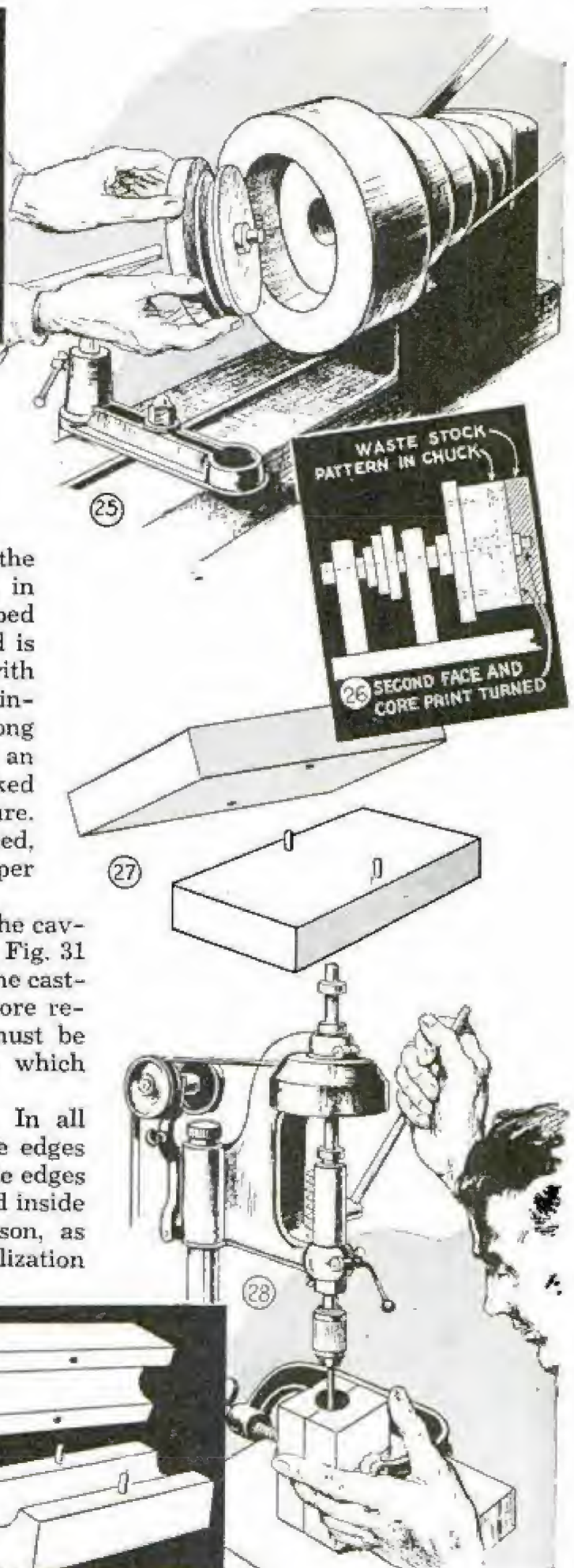


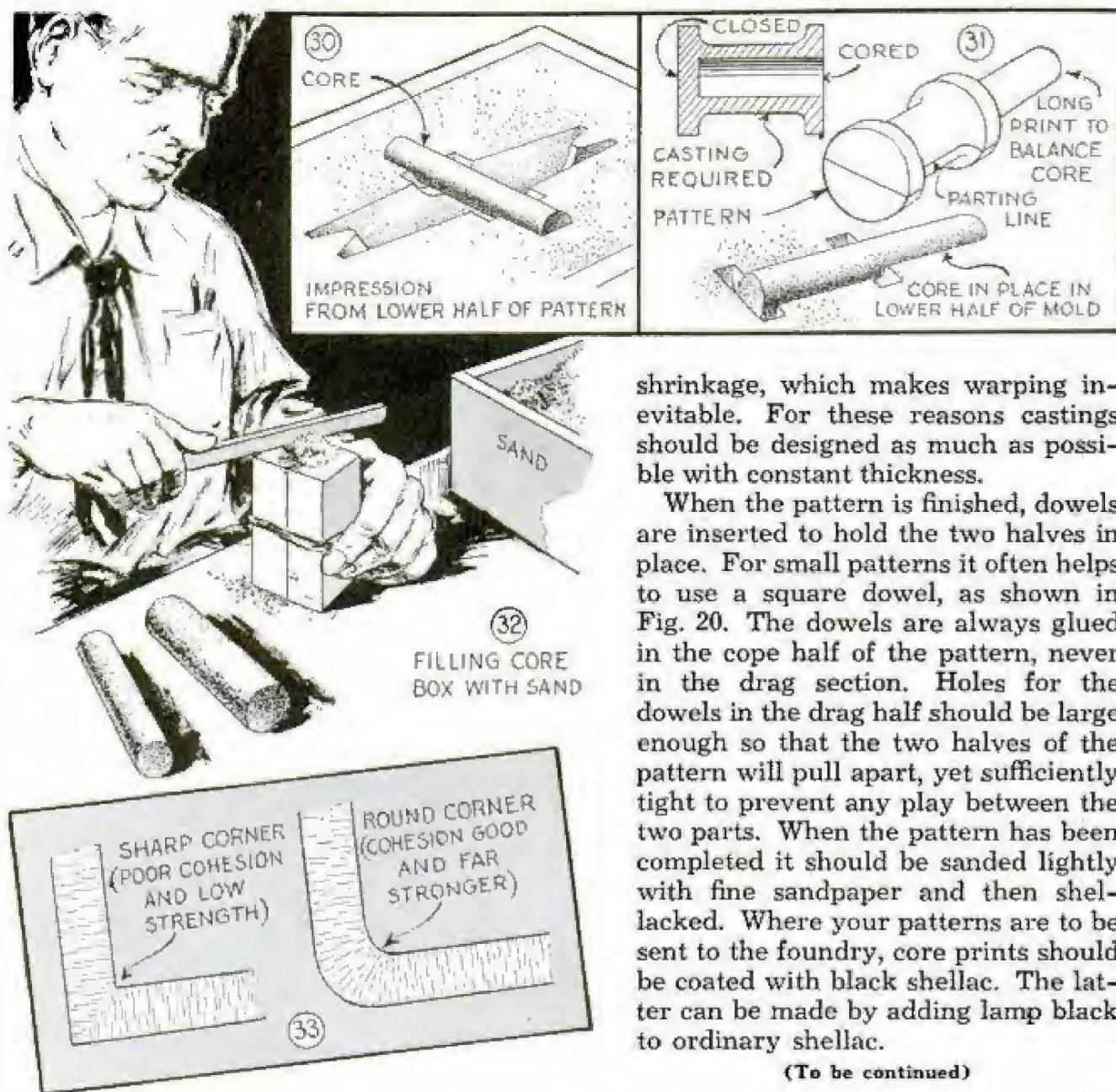
required, involving the use of carving chisels.

The core is made from common molding sand to which a small amount of some binding material such as linseed oil, molasses, or flour is added. The sand is dampened and the mold rammed full, and struck off as in Fig. 32. After this, the core box is rapped lightly to loosen the rammed core, and is then opened. Sometimes, especially with a long and slender core, iron wires are inserted in the core box to reinforce it along the length. The core is then placed in an oven at about 400 degrees F. and baked slowly to remove all excess moisture. When the mold for the casting is finished, the baked core is inserted in the proper position before closing the flask.

In some cases a core must overhang the cavity formed in the sand by the pattern. Fig. 31 illustrates an example of this, showing the casting to be made, the pattern, and the core required. In this case the core print must be longer than that portion of the core which overhangs the mold.

Now something more about fillets. In all castings it is necessary to avoid square edges and corners as much as possible. Outside edges of the casting should be rounded off and inside corners should be filled in. The reason, as shown in Fig. 33, lies in the crystallization characteristics of the metal. Crystals form perpendicular to the surface. The result is that the crystals fail to cohere at sharp corners. Shrinkage at the corner is in two directions, and the crystals are likely to pull apart and leave a crack or cavity, called a shrink hole. If the corners are rounded





shrinkage, which makes warping inevitable. For these reasons castings should be designed as much as possible with constant thickness.

When the pattern is finished, dowels are inserted to hold the two halves in place. For small patterns it often helps to use a square dowel, as shown in Fig. 20. The dowels are always glued in the cope half of the pattern, never in the drag section. Holes for the dowels in the drag half should be large enough so that the two halves of the pattern will pull apart, yet sufficiently tight to prevent any play between the two parts. When the pattern has been completed it should be sanded lightly with fine sandpaper and then shellacked. Where your patterns are to be sent to the foundry, core prints should be coated with black shellac. The latter can be made by adding lamp black to ordinary shellac.

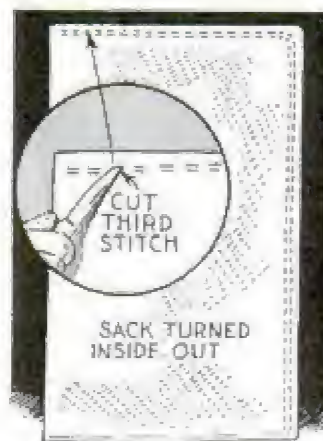
(To be continued)

there is a gradual change in the direction of the crystal axis, and the strain is far less, resulting in a stronger casting. This is a matter which should be considered in designing an article for casting. In making the pattern, the outside corners are simply rounded off. Inside corners can be made sharp if more convenient, and then filled back with fillets.

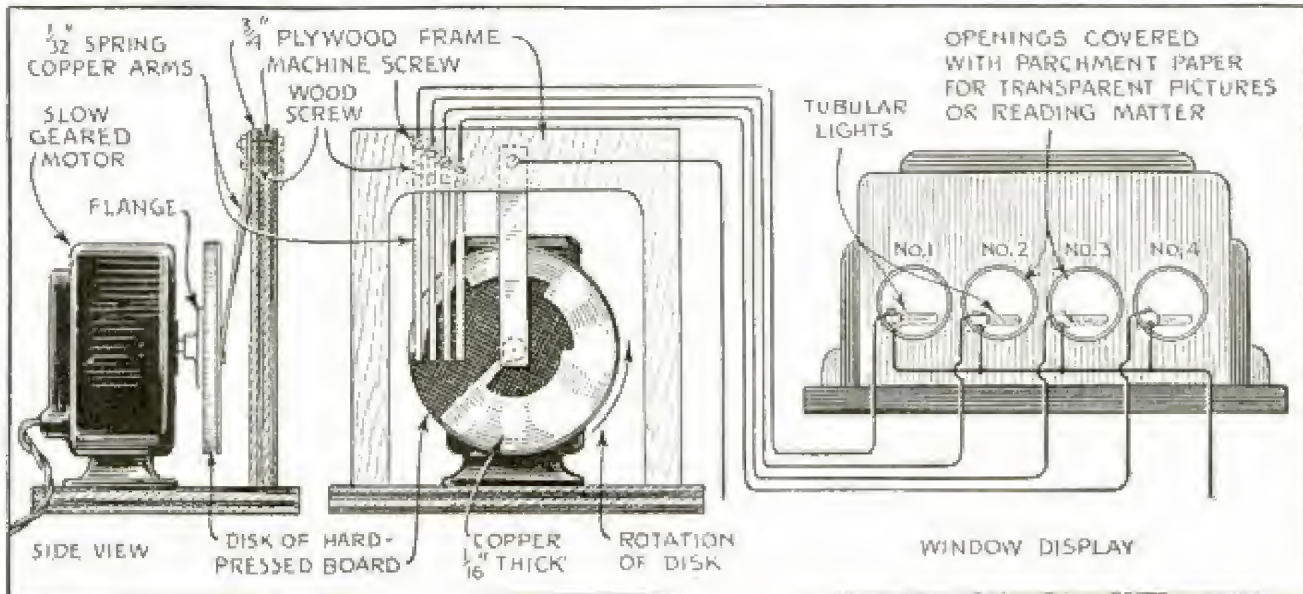
Another point to remember in designing articles to be cast is to have as few changes in thickness as possible. Whenever a change in thickness is necessary the change should be made as gradual as possible. Thick and thin sections of the casting will not cool at the same rate and consequently distortion is likely. Moreover, where the difference in thickness is considerable, there actually will be a difference in the

How to Unravel Stitches Quickly When Opening Cloth Sack

When you wish to open a sack of any kind so that the full width of the cloth may be used for some other purpose, simply turn the sack inside out, and with the double stitch to your right, cut the third stitch on either side of the sack with a sharp knife. Then by pulling the ends of the severed string, the sack may be opened.



Motorized Switch Flashes Lights in Sequence



An eye-catching window sign can be made to spell out a single four-letter word, or it will display a series of illuminated pictures or advertising copy in sequence. The display unit may be a rectangular box divided into four light-tight compartments. A single opening in each is covered with ground glass or simply parchment, and the letters or figures to be displayed are mounted behind it so they cannot be seen until a lamp inside is illuminated. In operation, the light in compartment No. 1 flashes on, then, after a short interval, the lights in 2, 3, and 4 go on in sequence. Each lamp remains lighted until all four are on. Then after another interval all four lights go off simultaneously. In a few sec-

onds the cycle is repeated. A speed-reduction motor is needed if the switch is mounted directly on the shaft, or the switch can be mounted on any speed-reducing unit driven by a motor. The two wires having unconnected ends go to the current supply to operate the lamps. For this purpose, you can use a 6-volt storage battery, providing small 6-volt lamps behind the parchment windows of the sign box. However, if you use 110-volt current in this circuit, it will be necessary to install a line filter especially designed for sign flashers to eliminate interference in near-by radio receivers. Such a filter is obtainable at most radio stores.

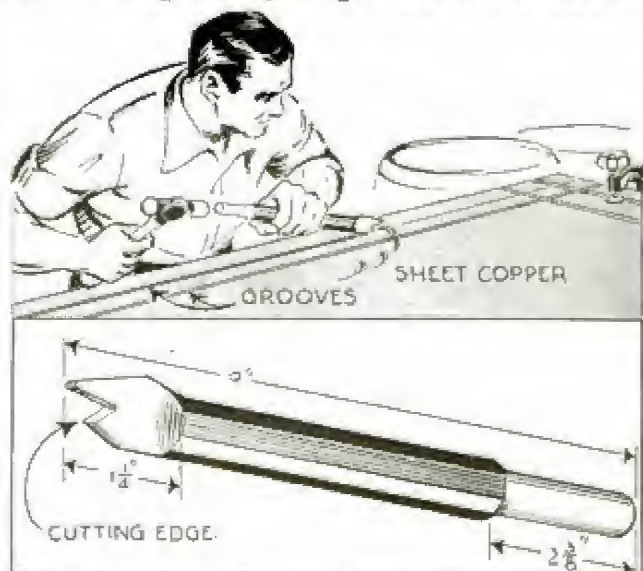
—Wm. H. Winkler, Pittsburgh, Pa.

Lip Above Cutting Edge of Chisel Stops Flying Metal Pieces

For cutting rivets or for making grooves in soft metal, such as copper, this chisel is just the thing because it has a lip overhanging the cutting edge that prevents particles of metal from flying. Workmen in shops where considerable hand-chiseling is done can make it easily from tool steel to any size desired. The chisel dimensioned in the detail is the size most commonly used.

—V. Vazza, Winnipeg, Manitoba, Can.

When it is necessary to prevent a number of rope ends from raveling, dip them in varnish which has been exposed to air until it is double the usual consistency.



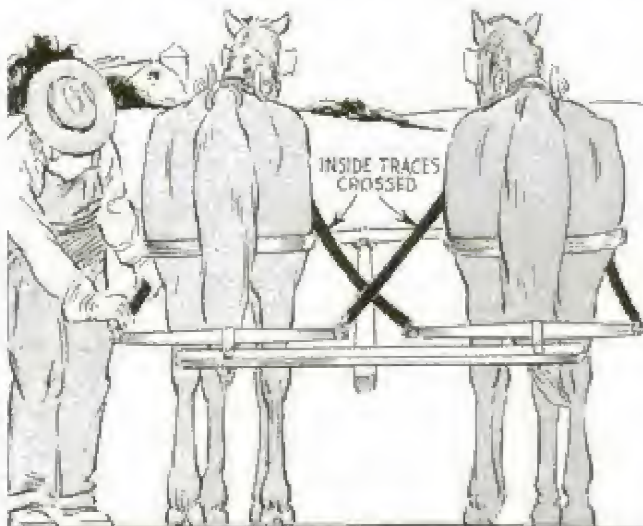
Enamel Letters on Glass Removed with Violin String



Enamel letters that have been attached to a window glass with the usual cement used for this purpose can be removed with a gut violin string without danger of breaking the glass. Just scrape away a little of the cement at the top of the letter to allow the string to rest on the troughlike space. Then apply a seesaw motion to the string, pulling downward as the cutting progresses. A little powdered rosin applied at intervals will hasten the cutting action.

This Simple Hitch Evens Pull of Unmatched Team

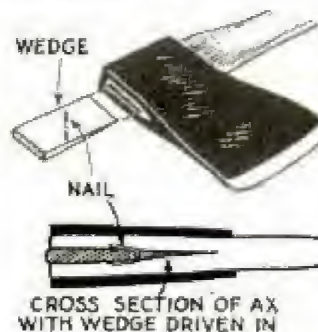
When a team of horses have a tendency to pull unevenly, cross the inside traces as



shown. According to an experienced farmer, this will result in even pulling of the team in practically every instance.

Brad Driven Through Wedge Prevents Loosening

To keep wooden wedges from loosening in ax or hammer handles, one carpenter drives a headless brad through the wedge at the approximate point indicated. When the wedge is driven into place, the brad bends and is imbedded in the handle.

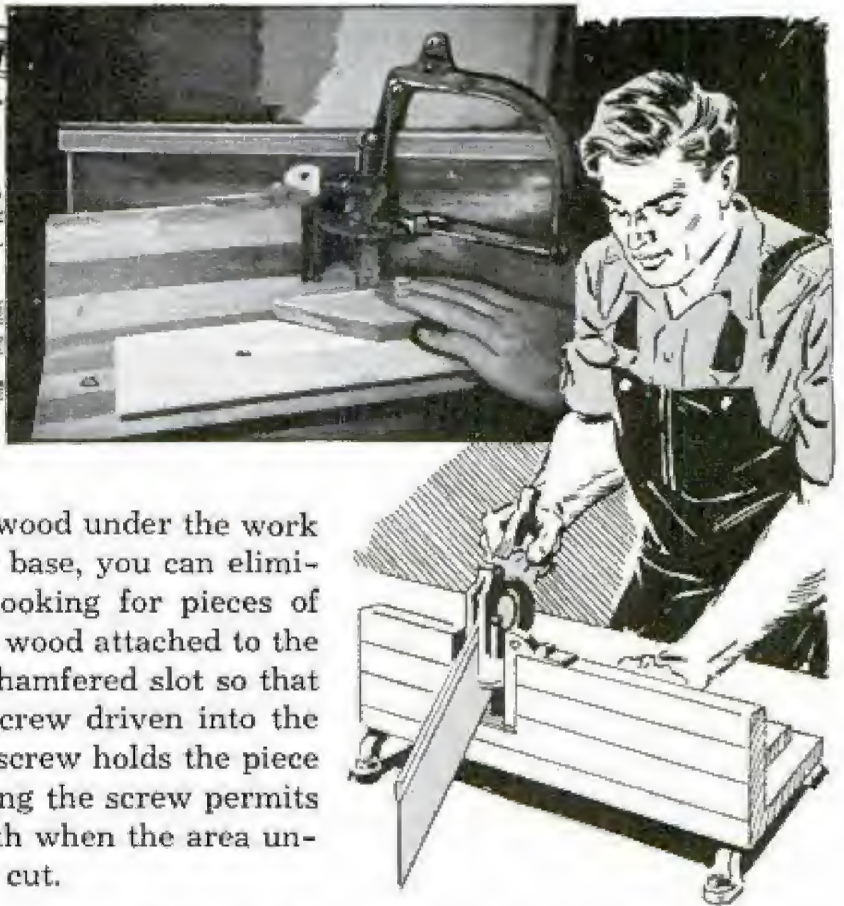
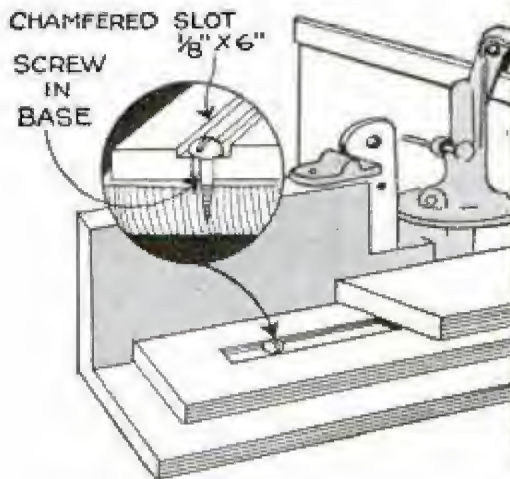


Washing Machine on Display Also Actuates Sign



Killing the proverbial two birds with one stone, a hardware dealer utilized a washing machine displayed in his show window to actuate a sign. The latter was an endless "belt" of black oilcloth on which was printed his advertising message. To rotate the belt, it was run through the wringer rollers and over a rolling pin, which rotated between two angle-iron brackets screwed to the floor of the window. Care must be taken in aligning the rolling pin with the wringer rollers.

Slotted Wood Strip Saves Base of Miter Box



If you have to place a strip of wood under the work in your miter box to protect the base, you can eliminate the bother of constantly looking for pieces of scrap wood by keeping a strip of wood attached to the base. The piece should have a chamfered slot so that it will slide on the shank of a screw driven into the miter-box base. Tightening the screw holds the piece securely on the base and loosening the screw permits the piece to be slid back and forth when the area under the saw teeth becomes badly cut.

Muslin Impregnated with Wax Is Substitute for Glass

A farmer uses muslin impregnated with paraffin as an inexpensive substitute for glass to cover hotbeds, poultry scratch sheds and even as emergency replacements for broken windowpanes in his barns and

stock sheds. The cloth admits a surprising amount of light, is impervious to moisture or wind currents, yet allows sufficient air to filter through it to provide good ventilation. To prepare the impregnating solution, melt some paraffin. After removing it from the fire quickly stir in benzine or pure gasoline in the proportions given in the drawing. This keeps the paraffin in liquid form when cool. The consistency of the solution can be controlled by varying the amount of gasoline. The cloth is dipped in the liquid and is hung up to dry, stretching it to avoid wrinkles.



Opening Drain Outlet on Roof

When snow on a flat roof melts from the heat inside the building it often freezes at the firewall outlet drain, which is hard to free. One can save labor by inserting a piece of pipe or a crowbar into the outlet before cold weather starts. Then if water freezes in the drain just tap the pipe until loose and pull it out. Then insert the pipe into the drain again for the next freeze.

Brush and Currycomb Are Handy in Pocket on Barn Post



To keep a brush, currycomb and other accessories conveniently at hand near his horse stalls, a farmer uses a pocket made from a section of auto casing. This is nailed to a post between the stalls as indicated.

—G. E. Hendrickson, Argyle, Wis.

Sponge Rubber on Paper Backstop Aids in Mimeographing Cards

If a piece of sponge rubber is attached to the paper backstop of a mimeographing machine when printing cards, it will help



to keep them from binding and curling. A rubber band will hold the rubber in place.

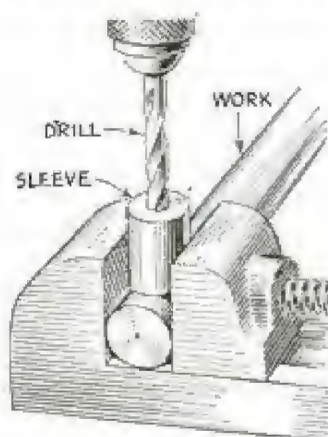
—Walter F. Horan, Plainfield, N. J.

Angle-Plate Scale Saves Time

When layout work is done by means of a scribe and an angle plate, a scale attached to the latter will save time. The scale is doweled and screwed to plate at right angles to the base so that the zero mark coincides with the base surface. In use, the work is clamped parallel to the rule. Any lines to be scribed can be set directly from the scale and laid out on the work.



Centering a Hole in Round Work



Drilling a hole transversely through a rod or pipe is done easily by using a metal sleeve of the same diameter as the work. The hole in the sleeve must be the same size as the drill to be used. After the work has been clamped

in a vise as indicated, the drill is fed through the sleeve, which acts as a guide.

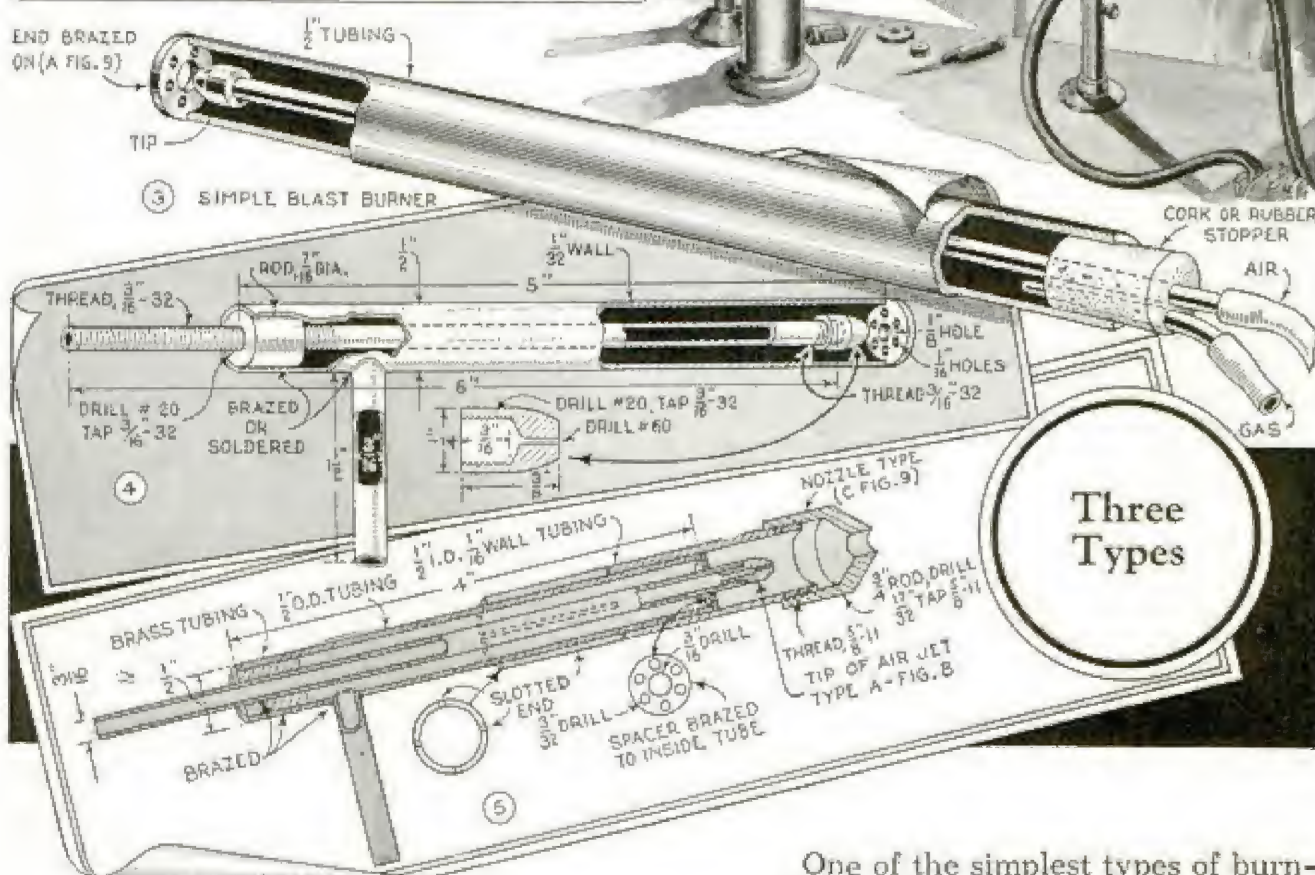
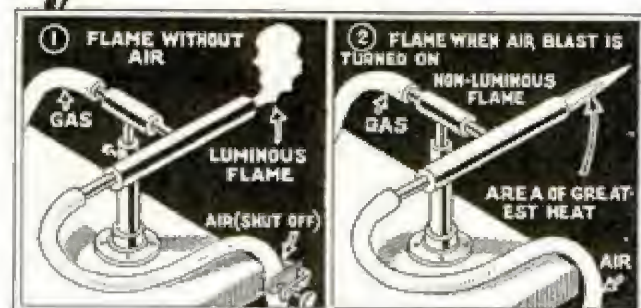
Keeping the Bristles of Brushes Shaped for Show-Card Work

After using show-card brushes, clean them, shape the bristles, clamp them in a paper clip of the type shown and hang them up. When needed next time, the brushes will be shaped and ready for use.



BLAST BURNERS

you can make



AN INEXPENSIVE blast burner is just the thing in a small shop or home workshop for soldering, light brazing jobs and for heating glass for bending. In fact, the concentrated, intensely hot flame produced by the burner makes it suitable for many jobs where a high temperature is required. Anyone can make one from brass rods and tubes. The principle of a blast burner is shown in Figs. 1 and 2. Gas is fed into a large tube and is burned at the end of the tube. Compressed air is fed by a nozzle into the heart of this flame, producing a concentrated, high-temperature flame that is non-luminous.

One of the simplest types of burners to make is shown in Fig. 3. A washer of suitable size is soldered or brazed on one end of a length of brass tubing, and a cork or rubber stopper is inserted at the other end. The gas is fed through a tube inserted in one hole in the stopper and the air is fed through another tube, which is centered in the stopper, extends the entire length of the tube and has a tip threaded or brazed on the end as in Fig. 8. A cork stopper can be drilled with a piece of brass tubing ground to a knife-edge at one end. In drilling a rubber stopper, the tube should be lubricated with a strong sodium-carbonate (washing soda) solution.

A more elaborate type of burner is shown



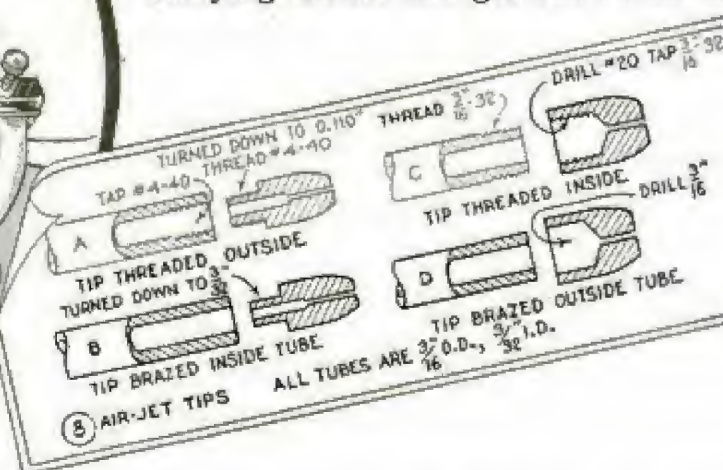
in Fig. 4. A piece of seamless brass tubing is used for the barrel. Near one end a piece of small-diameter brass tubing is soldered or brazed into the barrel, forming a side arm for the gas to enter. The other end of the barrel is fitted with a $\frac{1}{2}$ -in. brass disk or washer as shown for the burner in Fig. 3. This should be brazed on. The air jet is fitted to the barrel and can be of any of the types already mentioned. If preferred, the air tube can be a sliding fit in the plug, instead of being threaded. It is best to make the tip removable, so that jets of various sizes can be provided for different types of work. The type shown at A, Fig. 8, is probably the best to use. Also, the barrel can be fitted with one of the other types of nozzles shown in Fig. 9,

Here, type C has the advantage of being interchangeable. This is simply a matter of preference, as proper adjustment will make each satisfactory.

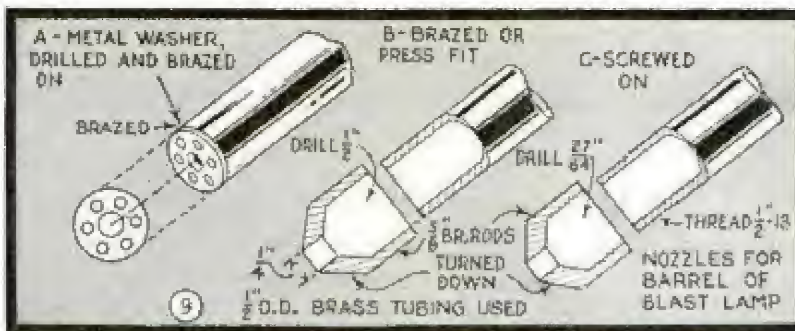
A third type of torch is shown in Fig. 5. In this torch the position of the air jet is fixed, as the air tube is brazed or soldered to the barrel at the end. Also note that it is centered permanently by means of a spacer in the inner barrel. Adjustment of the flame is accomplished by sliding the outer barrel, which carries the nozzle, up or down on the inner barrel. The nozzle for this type of torch can be any one of the types shown in Fig. 9. Additional tips for the air jet, drilled with holes larger than No. 60, and additional nozzles for the barrel can be

provided to give a variety of sizes and types of flames suitable for all kinds of work.

When the torch is completed, it should be mounted on a base of the type shown in Fig. 7. The air and gas inlets can be fitted with small petcocks, such as can be bought at any hardware store, or the rubber tubing carrying the air and gas can be fitted

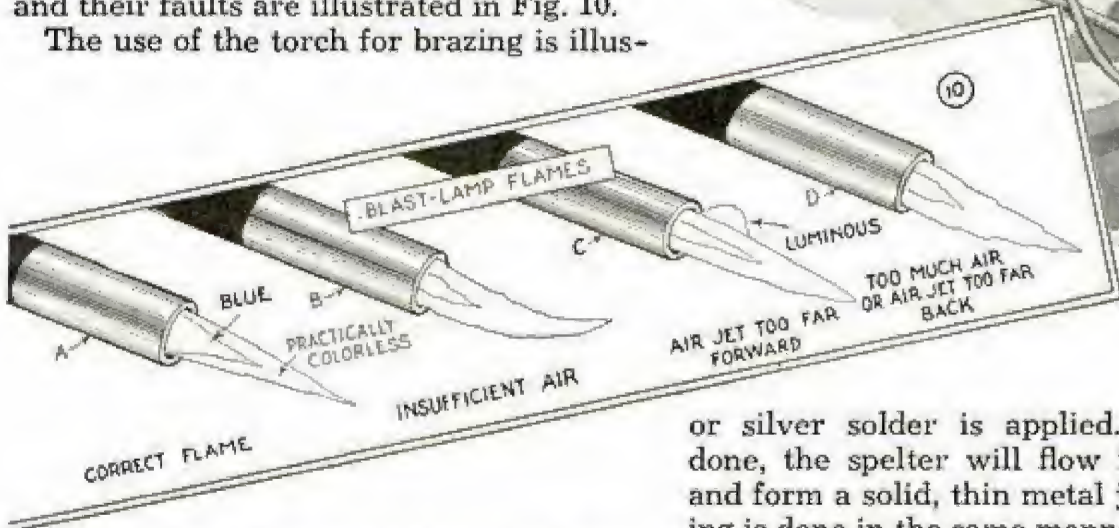


with small clamps. If desired, you can make these from thin flat iron, which is drilled and tapped at one end to take a thumbscrew, then bent to a wide U-shape. A short piece of the iron notched at one end to straddle the back part of the U-shaped piece "floats" under the thumbscrew end to prevent puncturing the tubing. The torch should not be attached permanently to the base, as it frequently will be more convenient to carry it to the work. A hardwood block cut from a piece of 2 by 4-in. lumber provides a good base. If this is just heavy enough to keep the torch from tipping it can be carried about easily and set down wherever the torch is needed. The torch should be attached to the gas and air outlets with good grade of rub-



ber tubing. In use, the gas should be turned on first and ignited, then turned down until a fairly small flame is produced, as shown in Fig. 1. The air then should be turned on slowly and the position of the air jet adjusted until the flame appears as shown in Fig. 2. Various flames and their faults are illustrated in Fig. 10.

The use of the torch for brazing is illus-



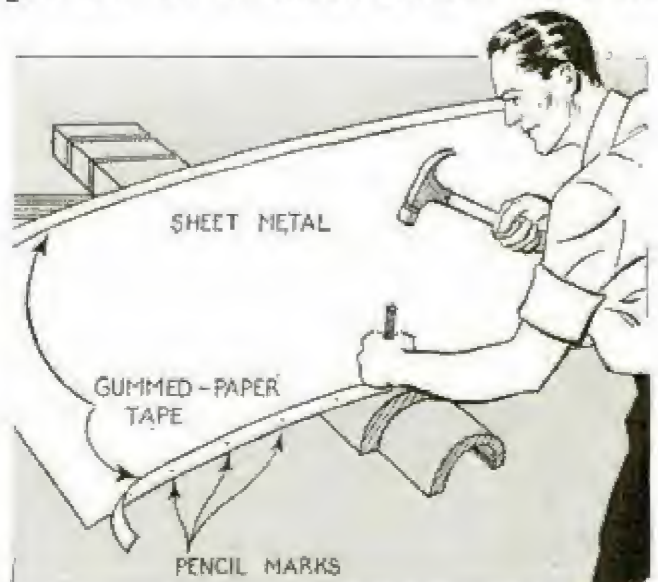
trated in Fig. 6. The work should be heated with the torch and the flux applied. Heat is continued until the work is at the proper temperature and then the spelter

or silver solder is applied. If properly done, the spelter will flow into the joint and form a solid, thin metal joint. Soldering is done in the same manner except that heating is discontinued just before the solder is applied. If you are inexperienced in this work, it may take a little practice to become efficient.

Gummed Tape Aids in Laying Out Work on Sheet Metal

When laying out long sections of sheet metal that are to be marked for accurate punching, a tinsmith puts strips of gummed-paper tape on the metal and marks the locations to be punched on the tape with a pencil. The marks are easy for the workman to see, and if corrections are necessary, they can be made without marring the work.

Paraffin can be used to lubricate a drill when drilling aluminum. Also when finishing aluminum patterns which have been scraped and filed to shape, rub paraffin on the sandpaper. It prevents clogging and allows the paper to cut cleanly.



Celluloid Guards on Car Door Protect Upholstery



If the upholstery of your car door near the bottom is soiled and scuffed, clean it thoroughly and then tack a piece of celluloid over it as indicated. The celluloid will hardly be noticeable and if soiled by dirt from the shoes, can be cleaned with a damp cloth.

Truck Endgate Swings Downward to Serve as Step

This endgate automatically swings downward to serve as a step when it is opened. The T-shaped bars that support



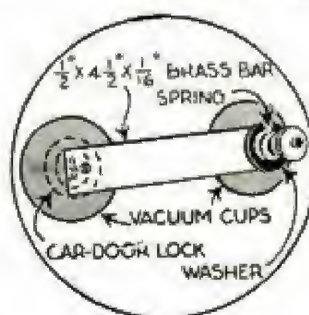
the endgate are suspended from swivel rings, the enlarged ends of the bars providing the stops. Bolts projecting from the truck body as indicated keep the step in a horizontal position. Hooks that hold the gate closed are mounted inside the body to avoid interfering with its operation.

Late Model Hub Cap Raises Tire for Easy Attachment of Chains

Carry a deeply cupped hub cap in your car and you will find it handy to raise a wheel when putting on chains. Just lay the chain over the cap and move the car so that the tire rests on the cap. It is better if the tire rests a little off center on the cap. This will allow you to stretch the chains tightly and fasten them in place without using a jack.



Vacuum Cup Covers Door Lock to Avoid Freezing



Annoyance of having water freeze in his car-door lock was avoided by a motorist who covered the lock during cold wet weather.

Two vacuum cups fastened to a brass strip were used, one to cover the lock and the other to stick to the side of the door. The latter cup was fitted with a small coil spring, as shown, so that tension would be applied to the other cup to press it tightly over the lock.

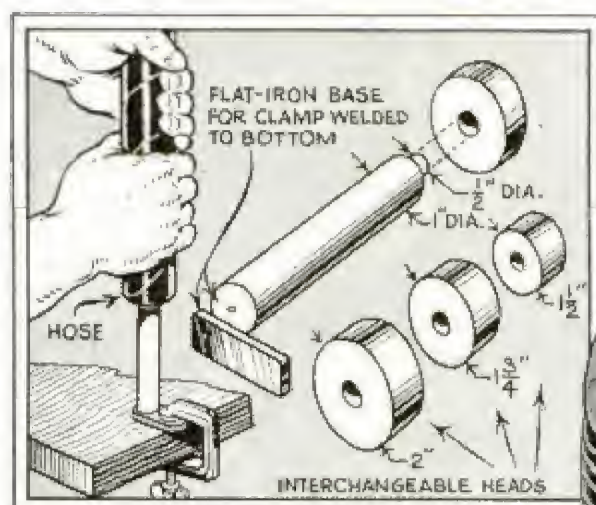
—A. J. Dunlap, Calumet City, Ill.

Quieting Noisy Hood Fasteners

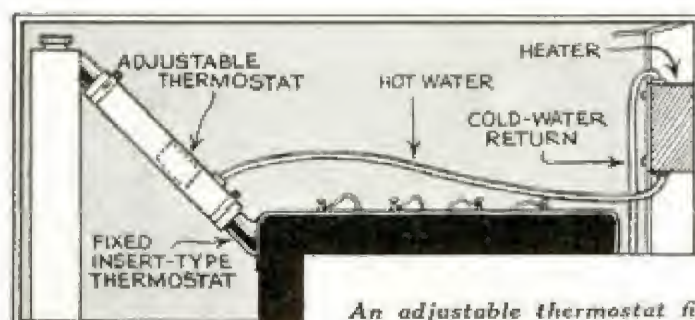
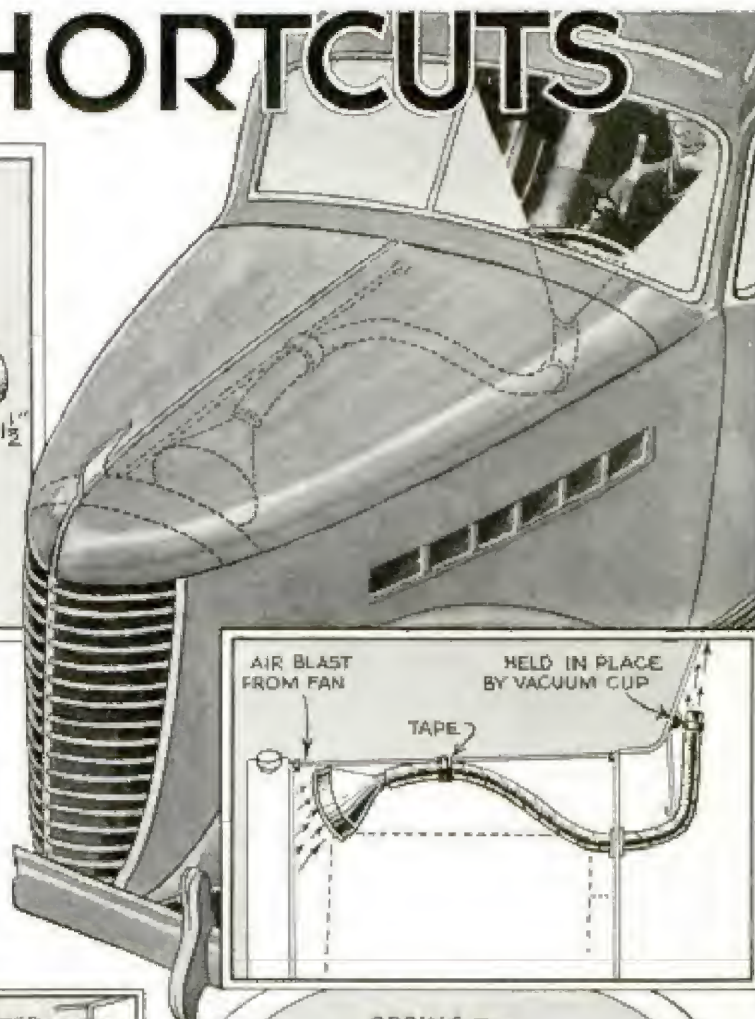
If a hood fastener on a Ford becomes noisy and works hard, pack the spring inside it with good grease, and oil the shaft that runs through the hood on the handle. This will stop the noise and make the hood much easier to open and close.

—H. Thomas Winston, Claremont, Va.

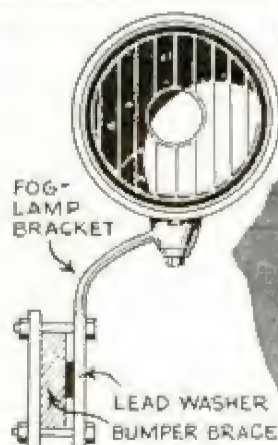
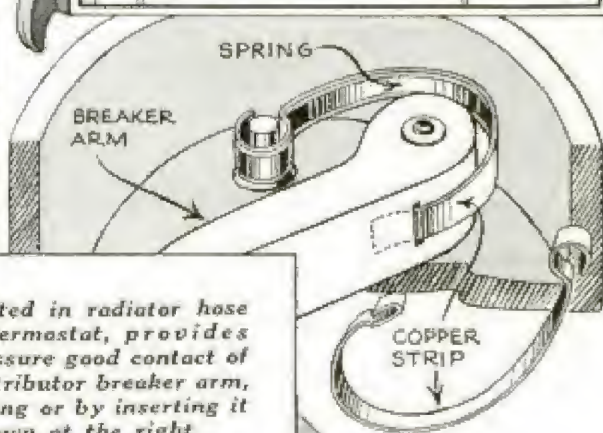
AUTO SHORTCUTS



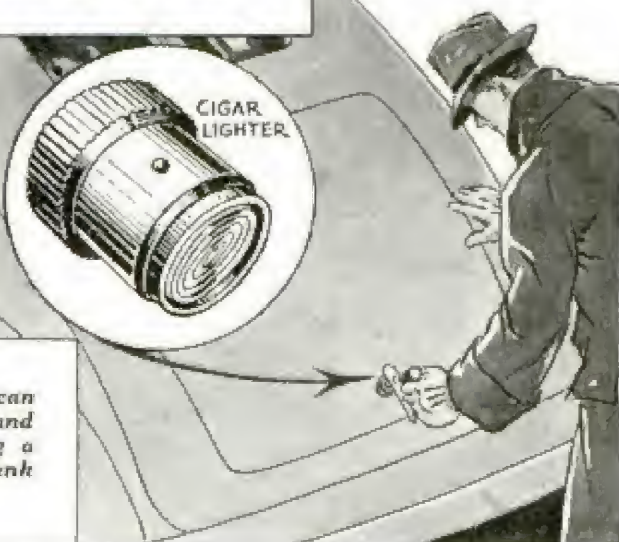
Right, warm air from radiator forced through tube by fan to keep truck windshield defrosted in extremely cold climate where usual types of defrosters do not supply sufficient air volume. Above, jig to remove or replace insert-type of thermostats from radiator hose. Interchangeable heads adapt the jig to hose of various diameters. It is held in a vise or clamped to a bench, and the hose pushed down over the head to force out the thermostat



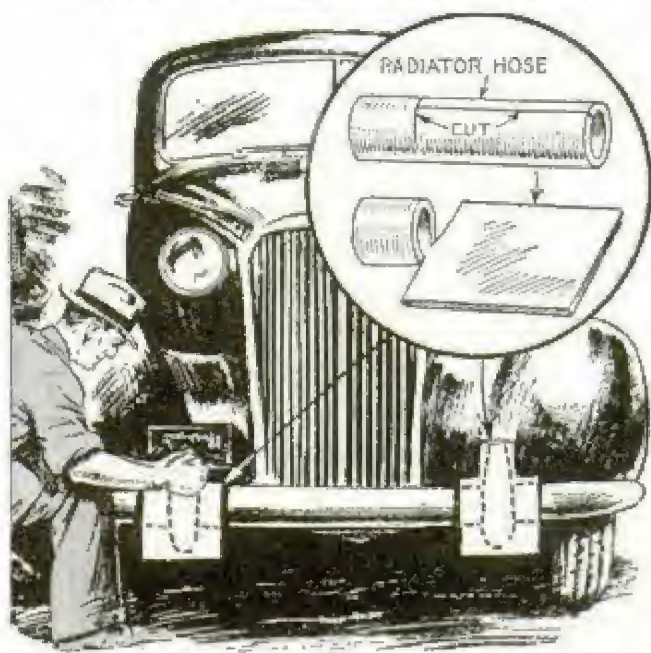
An adjustable thermostat fitted in radiator hose above the regular "fixed" thermostat, provides hotter water for heater. To assure good contact of the copper strip on a new distributor breaker arm, be sure to fasten it by soldering or by inserting it behind the spring as shown at the right



A good electrical ground connection on a fog lamp can be had by sanding the surfaces of both the bracket and bumper brace at the point of contact and inserting a thin lead washer as above. Right, frozen lock on trunk is thawed by means of a hot cigar lighter



Rubber Shield on Bumper Guard Protects Chromium Finish

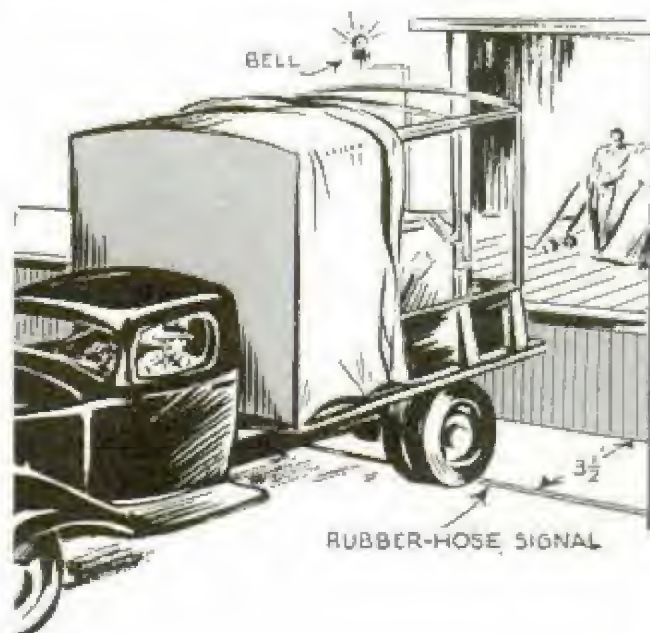


To keep my bumper guards from being scratched when pushing another car or when my car is being pushed, I made shields from short pieces of large radiator hose. These were cut as indicated in the detail and quickly slipped over the guards whenever needed.

—W. C. Wilhite, Carlinville, Ill.

Bell-Warning System Aids Truck Backing into Loading Platform

Stretched from 3 to 5 ft. in front of a loading platform, a rubber-hose signal system of the type used at many filling sta-

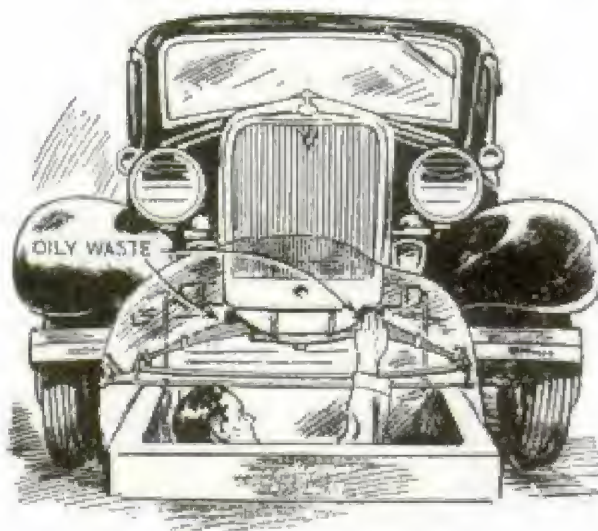


tions will save time for truck drivers. When the rear wheels pass over the hose, the bell sounds so that the driver knows he is close to the platform. This enables him to back quickly until the warning is given, then ease up to the platform.

Bleeding Hydraulic Brakes Easily

When it is necessary to remove the master cylinder of a hydraulic-brake system, I find the following method a timesaver in bleeding it on some cars. After the cylinder has been reinstalled, fill it with fluid and remove the stoplight switch from the cylinder housing. Then pump the brake pedal slowly until fluid pushes all air out through the stoplight hole and fluid is coming out. Screw the switch back in place while the fluid is running, to avoid letting air enter. This will remove the air from the lines without bleeding the wheel cylinders.—John C. Albin, Columbus, Kans.

Oily Waste Lubricates Springs Close to Car Frame



If you have trouble keeping the springs lubricated to avoid squeaks where they are attached to the car frame, soak waste with oil and force it snugly in place between the spring and frame. Oil will be squeezed from the waste by flexing of the springs, and keep them lubricated.

Ⓒ Sometimes it is suggested to use aluminum rivets to install brake lining, but it is best to use brass ones. If aluminum rivets are used, heat caused by friction will harden them and they may score the drums.

**OUTDOORS
IN SUNLIGHT**



*...and it's hard to say
which is better*

**INDOORS
AT NIGHT**



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C... Follow the few simple directions in the FREE Booklet

A few minutes with this helpful booklet and you're headed for splendid nighttime snapshots. Photos, diagrams, easy-to-understand directions. At your dealer's . . . Eastman Kodak Company, Rochester, N. Y.

Counting Noses

(Continued from page 249)

whether the home is owned free or is encumbered with a mortgage or is rented. The answers will provide information valuable to business, industry, real-estate operators and to the government agencies.

On the basis of the Indiana test the trailer dweller who happens to be in a certain state with no fixed residence elsewhere will be counted as a resident of the county in which he is "found." This means that, though the license plate on the trailer may read "California," "Maine," "Texas," or some other state, the "trailerite" will be enumerated as of "Cook County," Illinois, if, at the time of the census he is parked in that county.

To meet the assembly and classification problem of all this new data, stupendous beyond measure, the Census Bureau has perfected new mechanical apparatus. First is the breakdown of the country into "digestible" districts and the allocation of workers to these districts. There will be approximately 140,000 of these districts with individual maps for enumeration purposes. This meticulous map preparation is for the purpose of avoiding any overlapping of activities by enumerators and also to insure that not one square foot of the country will be missed.

The next stage will be the selection, training and equipping of the 140,000 enumerators who will visit every home, every farm, every factory and every place of business. Each enumerator will be given letterheads, envelopes, pencils and an instruction book, daily report blanks, schedules, a record book, a map and a detailed description for personal use.

Not until the enumerators are thoroughly grounded in the mechanics of the work they are to do will the actual census taking, or counting, be undertaken. And then it will be done very swiftly for the law calls for the job to be finished within thirty days. In the cities only two weeks will be allowed for the task.

The very minute that an enumerator has finished his count he will turn it over to his district supervisor who will check it for accuracy, after which he will rush it by mail to the Census Bureau in Washington.

Here a veritable beehive of robots and humans will set to work digesting the mil-

lions of important facts feeding into the giant Washington hopper. Something like 8,000 workers will wield 328,000 pencils over the mass of material descending upon the Census quarters, 600 typewriters click off data, 468 adding machines and 300 calculating machines. To estimate the amount of paper that will be consumed in this gigantic assembling and classification job would be impossible. It will run into countless reams.

Of the new robots that will be on the "front" the most interesting and spectacular will be the recently developed "census sorter." This machine has almost human intelligence in that it can sort into proper classification groups 300 census data cards per minute. Some forty odd of these machines will hammer away at their task during the height of the count. Another device is the semi-automatic population punch. This machine somewhat resembles a tiny typewriter with numerical keys from zero to nine. It punches holes in the schedule cards to record important population data. Its average production is 200 to 300 cards per hour. Some 800 of these devices will be used in the 1940 census.

The verifying machine will also render "human aid." It determines at once whether the population machine has cut the proper hole in each card. If a hole has not been cut where it should be the verifier refuses to move forward, simultaneously marking the error so the operator can correct his mistake immediately.

The last of this "machine intelligentsia" is the gang punch, devised by Bureau technicians. This machine has the special job of punching certain specific information on the census cards, such as state and county data. It can punch over 100,000 cards a day and is also valuable in checking the number of cards punched for the states, counties and cities.

The 1940 population count will reveal the many changes that have occurred in our social and economic life during the ten eventful years since the last census was taken in 1930.

❑ Send return postage to our Bureau of Information to learn the name of the maker of any device described in this magazine.

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Wagner Electric Corporation

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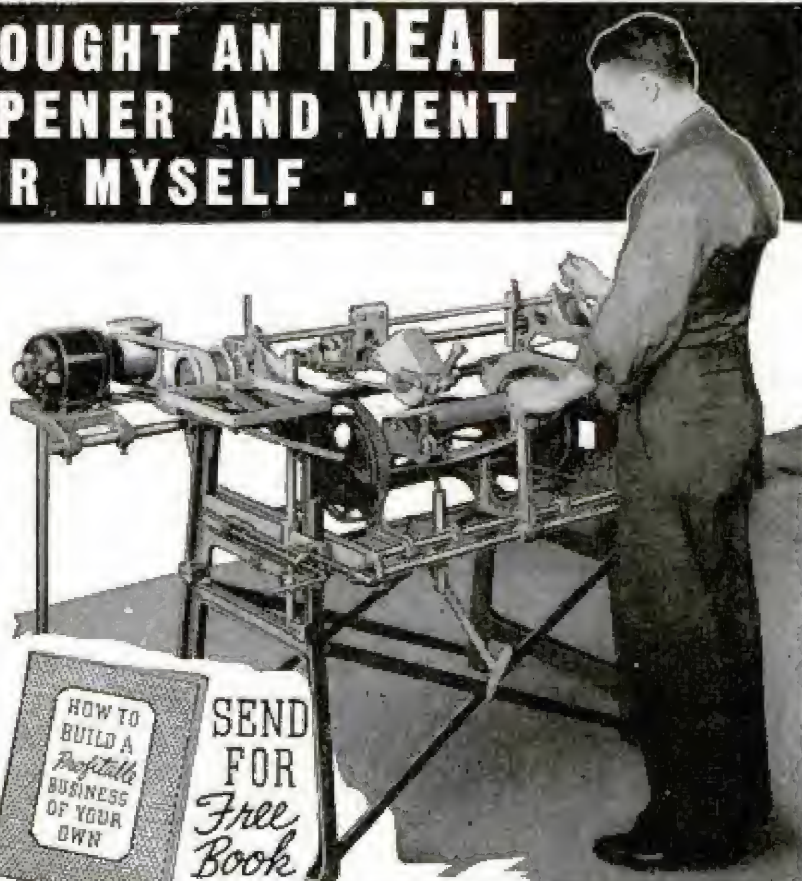
STATE _____ MAKE AND MODEL OF MY CAR IS _____

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YOU, TOO, CAN HAVE A PROFITABLE BUSINESS OF YOUR OWN . . .

Our free plans show you how to build a successful business of your own sharpening lawnmowers. Most men earn up to \$25 a week, even in spare time. Howard Hellen, Minn., writes, "I sharpened 745 lawnmowers, sold 60 used mowers and grossed \$1100.00 from April 5 to Sept. 15." Roy F. Stier, Wis., writes, "I paid for my Ideal Sharpener in exactly 36 days." Like magic, the Ideal Lawnmower Sharpener makes old, dull, badly worn mowers cut like new. Simply set the mower in the Ideal, make a few simple adjustments and the machine does the rest. Sharpens any mower to perfect edge in 15 to 20 minutes—usual charge \$1.00 to \$1.50. Attach to light socket. Start in your basement or garage. Work spare time or full time. Attachments for grinding skates, grass shears, hedge shears, sickles, scythes and axes. FREE CATALOG tells complete story.

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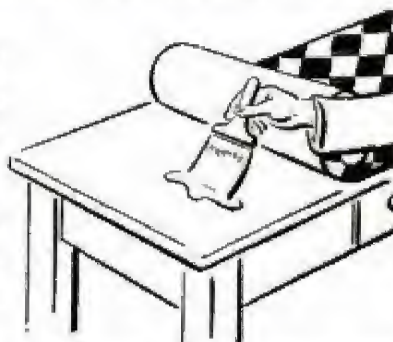
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Name _____

Address _____

-----Save 2c. Stick coupon on penny postcard-----

Making Better Home Movies

(Continued from page 254)

the film must also be turned over in projection, since the perforations are only on one side.

To make a title arrange itself on the screen, lay the title letters in place on a horizontal board and train the camera down vertically. While the camera is running, blow the letters away gently. When the processed film is turned end for end to make it run backward the letters will appear to move together and assemble themselves into a title. Other variations will occur to you such as having the pieces of a newspaper fly up from the ground and arrange themselves into a whole newspaper in a man's hands, a stunt that is made by turning the camera upside down and filming the man as he slowly tears the paper into shreds and drops them. Shooting backward makes water appear to run uphill or rocks fly up to your hand.

The most important single accessory you can add to your camera is an effect box that helps you perform dozens of professional tricks. The effect box can be described as a rigid overgrown sunshade extending out from the lens and at the front of which is a slot in which black cardboard shapes can be placed to mask off part of the scene. Cut-out masks in the shape of circles, keyholes, or binoculars placed in front of the effect box make appropriate borders for scenes.

An old camera bellows extending large end out from the lens makes a good effect box and an even simpler one is a tin can at least two inches in diameter, with a small hole in one end through which the camera lens fits and the other end open with guides fitted to it so that masks may be placed in front. The inside should be painted black, the box should be rigidly attached to camera or tripod, and it should be lined up with the lens and camera.

To make a double exposure such as a girl holding an animated conversation with herself, use a black mask in front of the effect box that cuts the scene in two. Place two chairs facing each other in the foreground of the scene and with the mask on the left side of the effect box film the girl as she sits in the right-hand chair, smiling and chattering as she faces the other chair. Wind the film back to the start, move the

mask over to the right side of the box, and re-film the girl on the same film as she sits and acts in the other chair. If the camera has no wind-back attachment it may be taken to the darkroom, unloaded, and repacked by hand, although it is difficult to keep track of the footage this way. Naturally, all such double exposures must be made with a tripod, and the camera must register exactly the same field of vision in the view finder with each exposure. Care must be taken to line the masks up exactly so that the two scenes on the same film neither overlap nor leave a gap.

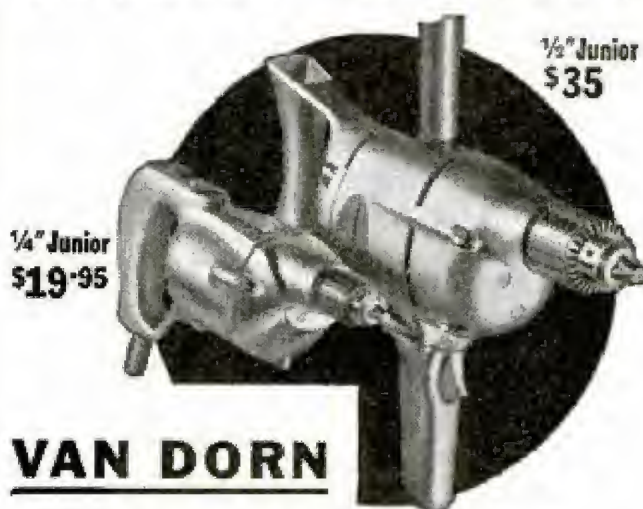
A freak type of double exposure that convulses the audience is to make up a friend as a clown. Have him hold his head perfectly still and roll his eyes wildly. Shoot only half of his face, screening off the other half with a mask in the effect box. Wind the film back, move the mask across and then shoot the other side of his face while he holds his eyes still or slowly turns them up and down. The effect on the screen is that the clown has independent control over each eye.

You can hide half a dozen friends behind a thin tree by centering the tree in the camera scene. Photograph the left half of the scene, including half of the tree, with the right side of the film masked off. Wind the film back, mask off the left half of the scene, and have the actors walk across behind the tree toward the right. Since their images won't register on the film until they emerge from behind the tree the effect is that they were all concealed behind the thin sapling.

For years Hollywood has used "glass shots" to screen out undesired backgrounds or to add scenery that doesn't exist. If you are filming a camping scene in the backyard and prefer a background of trees and mountains instead of fence and garden, place a sheet of window glass in front of the camera, far enough away for it to be in focus with the rest of the scene. About forty inches is right for most eight millimeter cameras. While you look through the finder, direct an assistant in tracing with a china pencil an irregular line on the glass that cuts out the undesired background. Outside of that line paint on the glass the scenery that you wish to show on the film, using oil paints and remembering that distant objects should be small. The

(Continued to page 118A)

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These brand-new $\frac{1}{4}$ " and $\frac{1}{2}$ " Van Dorn Junior Drills offer the power, ruggedness, perfect balance and superior points of construction usually found only in higher-priced drills. For "general-purpose" drilling—in small shop or large plant, these two new drills can't be beat for value or performance.

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113 Elm St.
CORTLAND, N. Y.

- Canoes \$66 and up
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- Very fast utility model

2452

(Continued from page 117A)

one-eyed camera has no way of measuring distances and if your perspectives are correct the illusion should be complete. Remember that shadows should fall the same way as in the foreground and that the foreground action will actually take place behind the glass, so room must be left for the actors to perform without disappearing behind the painted scenery. Make certain that the glass reflects no light into the camera, or use a polaroid filter.

A little experimenting with lighting will help you make use of creditable background projections. Use a large thin light-colored dull-surfaced window shade if you have no translucent screen and project a motion picture on this background from behind it. For a title, fasten the letters on the front of the screen and film that side while the motion picture from behind it shows through. The projector and camera must run at different speeds to avoid filming the lines between the frames. After you have tried this, try filming an actor in front of a moving background.

Now that some cameras are made with a single-exposure feature many amateurs are trying animation, taking motion pictures of dolls or models. The action is worked out carefully ahead of time and the actors are controlled by black threads that extend overhead. Pull the threads to operate the actors in steps that average an eighth of an inch of motion, exposing one frame of film between each motion. When done properly the effect on the screen is a smooth flow of action. A variation of this is to film model automobiles and airplanes while they are being moved by threads. Another use to which you can put the single-exposure feature is filming a sunset. Put the camera on a steady tripod and as the sun sinks into the horizon expose one frame of film every four or five seconds. Clouds will move in a stately manner and the sun will gradually descend.

These are some of the things that amateur photographers have learned from Hollywood. Already, says Mr. Physioc, experimental amateurs are contributing to the advancement of motion pictures just as amateurs in radio and other fields have helped develop their sciences.

Send return postage to our Bureau of Information to learn the name of the maker of any device described in this magazine.

John made \$42⁵⁰ in one day in his NEW Business



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a business which is so new that it is practically without competition. This should enable you to make really BIG MONEY. Hotels, homes, clubs, office buildings offer tremendous possibilities. Our new DETERGER washes upholstered furniture, electrically right in your customer's home, with a new soapless soap whipped into DRY suds. *No liquid touches the fabric*, therefore the furniture is ready for use soon after cleaning. We have helped hundreds of men get into business for themselves with our automatic equipment. The U. S. Government and many of the world's largest hotels use our machines.

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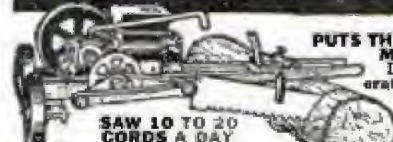
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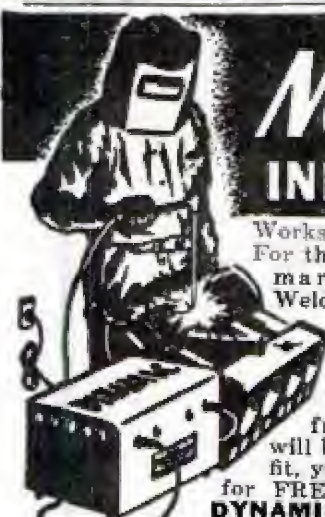
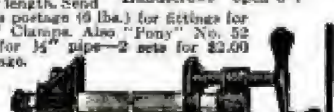
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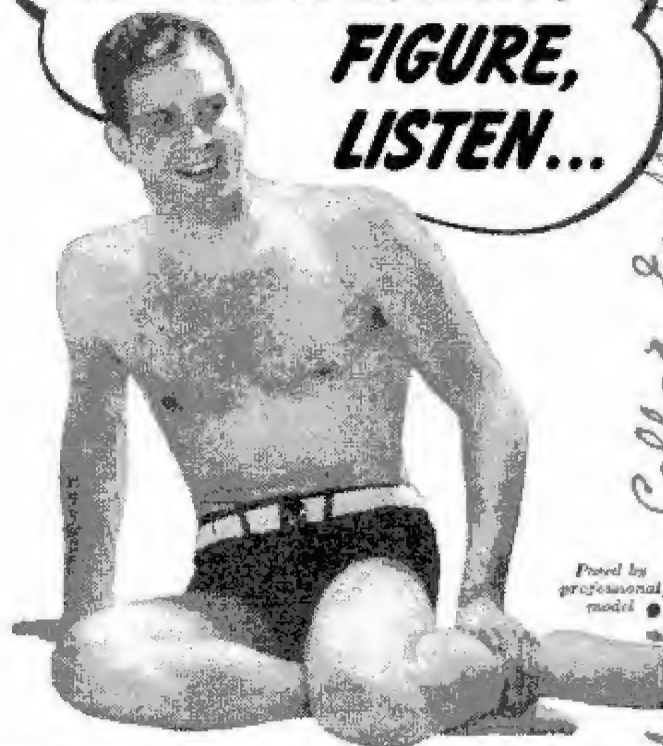
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Horseshoe

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OF YOUR SKINNY
FIGURE,
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model

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GAIN NEW POUNDS, NEW
STRENGTH... QUICK!**

HERE'S grand news for many of the thousands of thin, tired, jittery, discouraged men who have never seemed able to add an ounce, and seldom attract friends and have the good times they deserve.

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Why they build up so quick

You see, scientists have discovered that great numbers of people today are thin and rundown, tired and nervous—often unable to eat or sleep properly—only because they don't get sufficient Vitamin B and iron from their daily food. Without enough of these two vital substances you may lack appetite and not get the most body-building good out of what you eat.

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Get Ironized Yeast tablets from your druggist today. If with the first package you don't eat better and **FEEL** better, with much more strength and pep—if you're not convinced that Ironized Yeast will give you normally attractive flesh, new energy and life, the price of this first package promptly refunded by the Ironized Yeast Co., Atlanta, Ga.

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TUNE IN ON JOHN J. ANTHONY'S GOOD WILL HOUR.
See your local newspaper for exact time and station.

Super-Senses of Science

(Continued from page 197)

an electric "taste-indicator" which never catches cold; it can measure with infinite precision the acidity or alkalinity of a solution. As there are instruments to measure the intensity of light from stars, there are others that automatically record the amount of sunshine falling on a given spot. On a sticky midsummer day you may remark sagely, albeit futilely, that "it isn't the heat, it's the humidity," but you probably couldn't guess the relative humidity much closer than ten points. Modern industry can't merely guess, it has to know the amount of moisture present, so there is a moisture-detector; thrust two electric needles into the plaster, concrete, brick or wood wall to be painted and it will gauge electrically the exact amount of dampness on and under the surface. It will also help find leaks in pipes buried in the floor or wall.

If you're one of those nervous individuals who are kept awake by the ticking of a watch, you'd love a nap in that floating chamber in the General Electric laboratory that is probably the world's quietest spot. It is so silent that you imagine you hear the clicking of the turnstiles as you count sheep. Insulated by sound traps and sound-absorbent walls, this thirty-ton room is hung from springs that rest on rubber cushions on the building roof. Vibrations cannot reach it. In this chamber scientists play with noise, testing fans, motors, washers and other equipment in an effort to produce noiseless machines. The most efficient fan being the quietest one, blades are designed and redesigned until a fan spinning in the inner sanctum of the quiet room scarcely wavers the needle of the decibel meter. The efficiency of washing-machine agitators and dishwasher sprays is similarly checked on the decibel dial.

Infinitely more sensitive than the imperfect human ear are the electric "ears" that eavesdrop on a submarine cruising submerged more than fifty miles away and hear sky raiders approaching long before your eye or ear could take warning. Even more useful in long-range detection work are the high-frequency sound waves that flow right past your eardrums unheard. This inaudible sound of 50,000 to 100,000 cycles can be pointed like a gun, bounced

Colbert Campbell, 50 Church St., New York

off an unseen obstacle—a ship's hull, a submarine, a hidden roof—and its echo timed to locate the object. Similarly, the sonic altimeter of the airplane translates the echo of transmitted sound into the actual elevation of the aircraft above ground. Scientists believe that some birds, perhaps animals as well, talk to each other in voices too high pitched for man to hear; and it may be that the swift, unerring flight of bats is guided by nature's own sonic altimeter, an ear sensitive to the echo of a high note sung and heard only by the bat itself.

So men work and play with the unseen and the unheard. Infinitesimal charges of electricity emanating from invisible films only one ten-millionth of an inch thick on the surface of water are converted into sound and studied with earphones. Man cannot believe his eyes, so he builds a camera that has, instead of glass lenses, a thousand pin-point apertures arranged in rows around a revolving drum to photograph electric arcs at a rate of 120,000 exposures per second. Man needs a magnet of great power in a little space, so he puts together aluminum and nickel and cobalt and iron, heat-treats the combination, and produces a magnet half the size of the eraser on your pencil, capable of lifting a five-pound weight.

An inch may still be good enough for the carpenter, but it's far too crude a unit of measurement for the airplane builder or the turbine engineer. The inch was first legally defined in England in 1324 A.D. as the length of three grains of barley, round and dry, laid end to end. Twelve inches constitute one foot, which in various times was based on the human foot, the length of King Henry I's arm, or the span of thirty-six barley grains. In 1866 the United States Congress recognized the standard meter, but the inch, commonest unit of measure, has never been legalized.

The foot rule and the vernier and scale of a generation ago give way to the electric gauge of today, measuring generator parts and refrigerator motors and automobile cylinders within one ten-thousandth of an inch, capable even of measuring in millionths of an inch.

In a world of precision, the feeble human senses are not keen enough. But science has endowed man with electrical and mechanical eyes and ears and fingers far more acute than his own.



Get This

Household Inventory Booklet

YOUR fire insurance policy states that if there is a fire on your premises you "shall furnish a complete inventory of the destroyed, damaged and undamaged property."

Has it occurred to you how difficult it would be to prepare such a list *after* a fire? Many items would undoubtedly be forgotten until after your claim was paid and you signed a release!

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Specialty Products Co. Valparaiso, Ind.

Foot and large scale - see Jan 1949

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21066

The Young Giant of Sport

(Continued from page 229)

matter of timing. No matter what your position is within the shooting area, don't start for the ball too soon or too late on its rebound off the rim. Start for it just at the instant it hits the rim. This way you will just about attain maximum height as you hit the ball. Actually you will still be traveling upward and you are better able to give the ball a controlled push. Your chance of scoring is good because the ball has only a short way to travel up over the rim and into the net.

There are a couple of tricks you can learn about dribbling that will be a big help. Stand or move with your body crouched and your head up. A good dribbler watches the whole floor while he is advancing the ball. He needs to see the ball only out of the corner of his eye at the top of its bounce. Bounce the ball waist high and tap it again at the top of the bounce, taking up the shock with the palm of the hand and controlling the ball with the spread fingers. One of the exercises we use at Southern California is to blind-fold the players in training so that they can learn to dribble the ball as long as possible without seeing it at all. That gives them confidence.

Another thing that gives a team confidence is well-chosen uniforms. Knee guards that protect the wearer against floor burns are worn at all times and we use special shoes with built-in heels and arch supporters that have helped reduce the number of sprained ankles and other foot injuries. Vividly colored shirts and trunks materially improve a team's passing game. The player with the ball needs only to see a flash of color before passing to a team mate. Even socks colored the same as the rest of the uniform help him locate a man who is ready for the ball.

Basketball is an especially hard game to referee because it is so fast and because some actions may or may not appear to be foul, depending on the angle from which you happen to see them. The referee tries to watch every action from the best angle and gives his judgment accordingly. Remember that, if you don't always agree with his decisions. A good way to avoid fouls is for a few players to demonstrate the different foul positions in practice so

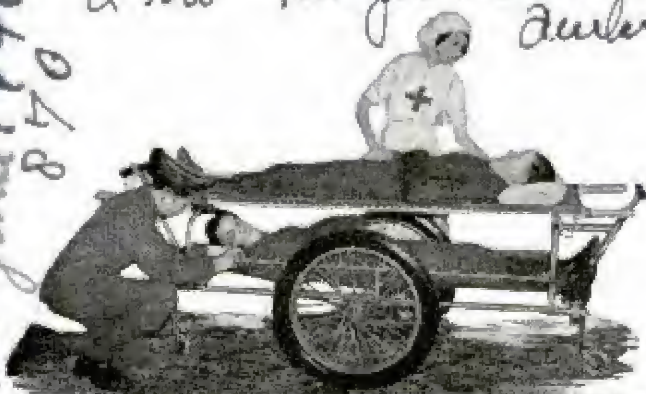
that the rest of the team can see exactly what they are not supposed to do.

Basketball puts a premium on agility. Because of that the training program is quite different. Quick starting, quick stopping, and quick changes of direction are very important and the players are trained with short dashes that include these maneuvers. Skipping rope is one of the best exercises and tap dancing is also part of the training program. The men pair up for "shadow boxing," one man pretending to bounce and advance an imaginary ball while a guard does his best to stop him.

These days we are scouting opposing teams and are working out special defensive and offensive plays based on what we can learn from motion pictures taken during the games. During a game we compile shooting charts from which the habits of each player may be studied. In some cases we may discover that a star player on an opposing team has one favorite spot from which he likes to make his throws at the basket and our defense is to try to prevent his reaching the area from which his throwing is best. Young players can use this as a tip. If you learn to throw baskets from a number of spots instead of having to get set at one particular place you will become a better player.

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Two persons can be carried on a double-deck hand ambulance designed to reach places where motor vehicles are unable to



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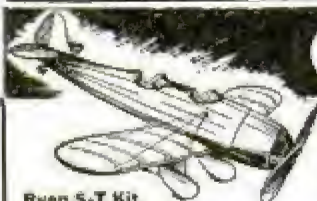


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WORLD FAMOUS • STANDARD MAKE TYPEWRITERS

as Low as
\$26.90

10 DAY TRIAL
No Money Down!



EASY TERMS

as low as **50¢ a week**

YOUR CHOICE—UNDERWOODS!

ROYALS! REMINGTONS! L. C. SMITHS!

WOODSTOCKS! As low as 1/3 mfr. original

price. Typewriters that cost up to \$110.00—some as low as \$26.90. Genuine, standard, full sized rebuilt office models

—up-to-date improvements—standard keyboard, back spacer, ribbon reverse, 2 color ribbon, etc. Never before such rock-bottom prices! FULLY GUARANTEED! Backed by 30 years of fair dealing. Ten day trial. Easiest terms in history—no low as 50¢ a week. FREE big price saving catalog shows all makes in colors, details on 10-day trial and easiest terms. FREE Van Vanda Touch Typing course with your typewriter. See catalog before you buy. Mail coupon now while stock is complete.

INTERNATIONAL TYPEWRITER EXCHANGE

231 W. Monroe St., Chicago, Ill. (Dept. 201)

Send Free Catalog in colors showing late model standard Typewriters at tremendous savings with no money down and 10 days' trial.

Name..... Address.....

Town..... State.....

The Rookie Goes to College

(Continued from page 235)

rookie wants technical training in the army, he can find it about as technical as it comes in the engineers. One of the famous units is the 29th Topographical Battalion, now stationed in the wilds of the Olympic Peninsula, opposite Seattle. This unit surveyed the Nicaraguan Canal route, and its work in aerial mapping on the Olympic Peninsula was the first thorough workout of this method of map-making over the most difficult terrain imaginable.

Army engineers build roads, bridges, railways, buildings, and the range of technical jobs embraces stationary enginemen, instrument repairmen, lithographers, pho-



Communications section field radio units offer the rookie opportunities in another phase of activity

tographers, painters, rodmen, structural ironworkers, draftsmen, and so on. The Engineer School is at Fort Belvoir, Va.

The Quartermaster Corps is the supply and general maintenance service of the army—and it's extremely important. Members of the QMC are often called the "businessmen of the army." They have to buy supplies and keep the transportation system going. In this day of motorization, the Transportation Division is of singular importance, and the QMC operates big motor transport schools, where enlisted men learn to take automotive engines apart and

(Continued to page 126A)

Get The INSIDE FACTS Before You Buy Power Tools



New Time Payment Plan

This Delta Tilting Arbor Saw is but one of the many power tools that typify Delta extra value and extra quality. It embodies numerous features and advantages described fully in the new 1940 Delta Catalog and here's good news—the complete line of Delta metal and woodworking tools is now available on liberal extended terms through Delta dealers. Send for details.

DELTA MFG. CO.

600-634 EAST VIENNA AVENUE
MILWAUKEE, WISCONSIN

If you are interested in power tools for your workshop—there are vital inside facts you simply *must* know before you can make a sound decision. These facts are now available to you in the

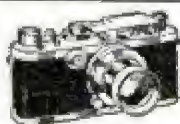
New 1940 Delta Catalog

which not only lists the complete line of Delta "Quality" power tools—but shows you the important points to look for in all power tools. It explains the advantages of "diamond-boring" of bearing seats, "pre-loading" and correct mounting of ball bearings and "sealed-for-life" ball bearings. It illustrates many hidden features of design and construction that make for long, better service in power tools. It takes up the major power tools one by one and analyzes various types of design and shows the advantages and disadvantages of each design. It shows you the features you should look for in selecting power tools for your shop. Truly this new 1940 Delta Catalog is A BUYER'S GUIDE—cramped with useful information that every craftsman should have. Send the coupon for your FREE copy (also send 10c for the new Project Book No. 6, containing working drawings and instructions for many new and "out of the ordinary" things to make).

Delta Mfg. Co., Dept. A-240
600-634 E. Vienna Ave., Milwaukee, Wis.
Send me the latest new 1940 Delta Catalog and list of Delta Dealers nearest me. ☐ I enclose 10c (stamps or coin) for which please send me the new Delta Project Book No. 6.

Name.....
Address.....
City..... State.....
☐ check here if you are a Delta user now.

CAMERA BOOK FREE!

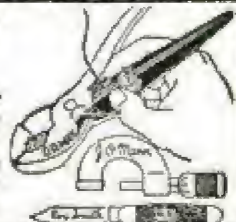


Illustrates latest methods in Photography and Home Movie Making, for fun and profits. Offers hundreds of amazing money-saving bargains in still and movie cameras, lenses, films, etc. Used equipment accepted in trade. Satisfaction guaranteed or money back with 10-day trial privilege. WRITE FOR FREE BARGAIN BOOK!

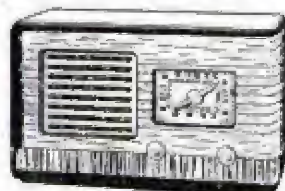
CENTRAL CAMERA CO., 230 S. Wabash, Dept. B-16, Chicago, U.S.A.

BURN YOUR NAME ON TOOLS WITH THE ARKOGRAF

PROTECT YOUR TOOLS FROM THEFT
Write with electricity any name or design on the hardest and finest tools and instruments, or any metal, like writing on paper with pen or pencil.
Complete Outfit \$3.50—Prepaid Anywhere
Interesting illustrated circular free. Write today.
Agents wanted.
ARKOGRAF PEN CO., 3927 S.E. Stark St., Portland, Ore.



8-TUBE, 2-BAND SUPER AC-DC



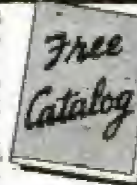
each in lots of six or \$12.48 when purchased singly. Regular \$24.95 list model **\$11.23**
3T3 GOLDENTONE. Check these 1940 features: Dynamic speaker. Walnut cabinet. Illuminated vernier aeroplane dial. "Goldenscope"—no aerial or ground required. Receives Coast to Coast on Broadcast and Police, Amateur, Aeroplane, etc., on Short Waves. One year guarantee. Send \$1.00 deposit, balance C.O.D. Money back if not satisfied. ORDER TODAY!

GOLDENTONE RADIO CO., DEPT. PM, DEARBORN, MICH.

RADIOS..SAVE UP TO 50%



DEAL DIRECT—FACTORY PRICES
Many models to choose from at wholesale prices.
AC-DC midsets \$4.98.
Portable and battery sets \$4.98 up. Car sets \$11.75 up. Also consoles, all-wave etc. Samples at 50% off. Send for FREE 1940 bargain catalog giving details of 10 day FREE trial and agent's proposition and discounts. No obligation, write today. GOLDENTONE RADIO CO., DEPT. PM, DEARBORN, MICH.



21076
(Continued from page 124A)**AGENTS and DEALERS WANTED****To Sell or Rent the NEW****Mead Ranger SCOOTER****AMAZING LOW PRICES!**

Buying Direct From Mead

Pay as you ride!

EASY TERMS
available in most states

Bicycle Circular Free on request

CYCLE CO.
Mead

17 S. Market St., Dept. E-1, Chicago

AMERICA'S MOST
FAMOUS CYCLE NAME
FOR FIFTY YEARS**HOW TO GET A DAISY****1 Use Your Christmas Cash!**

Buy your Daisy with money you got for Christmas. If you've spent it or didn't get any... and have a birthday between now and July 15, listen:

2 WE WILL HELP YOU GET A DAISY For YOUR BIRTHDAY! Just do This:

Send us your name, address, date of your next birthday. You'll receive Birthday Reminder Kit 2 weeks before birthday. It's FUN using it—and we hope it helps YOU get a Daisy for your birthday. Write quick!

DAISY MANUFACTURING COMPANY, 542 Union St., Plymouth, Michigan, U.S.A.

500
SHOT Repeating
Lightning-Loader
CARBINE
\$2.50 Higher
in Canada**NOW ONLY****\$4.95****REAL ENGINE VALUE**

Over 7,000 GHQ Gas Engine Kits were sold at \$8.50. Over 15,000 sold last year. Now is your chance to buy the New Improved kit for \$4.95. Absolutely complete with coil, plug, etc. For boats, planes, etc. All parts guaranteed. Send only \$1.—

Shipped Express Collect for balance same day. Send \$3 for new 16-page illus. catalog. DEALERS WRITE.

All parts finished. Only a screwdriver needed. 1/5 H.P.
Average assembly time 30 minutes.

GHQ MOTORS, 40B East 21 St., New York, N. Y.

FREE CLUB & CLASS PIN CATALOG
SHOWING OVER 300 DESIGNS**300 SMART DESIGNS!**

Knit your class or club closer together with pins or rings. Bastian has been the leading maker for 45 years. Clean cut, quality work. Write today for 1940 Catalog.

BASTIAN BROS. CO. Dept. 73, Rochester, N. Y.

Rheumatism **Relieve Pain in Few Minutes or Money Back**

To relieve the torturing pain of Neuritis, Rheumatism, Neuralgia or Lumbago in a few minutes, get NURITO, the fine formula, used by thousands. No opiates. Does the work quickly—must relieve cruel pain to your satisfaction in a few minutes—or your money back. Don't suffer. Clip this ad now as a reminder to ask your druggist for NURITO today.

put them back together. Equal in importance is the Property Division, which, among other things, keeps the soldiers clothed and equipped. A sales division operates commissaries and stores, as well as bakeries. Utilities are managed by another division.

The Quartermaster Corps also operates a fleet of transports and other ships. The Quartermaster Corps probably runs more kinds of schools than any other branch of the army. There is the main Quartermaster School at Philadelphia, teaching practical business methods, and a Quartermaster Motor Transport School at Camp Holabird, near Baltimore, Md. Schools for bakers and cooks are maintained at nine different posts in the United States and foreign departments. There is also a Horse-shoers' School at Fort Riley, Kan., and selected soldiers are sometimes sent to civilian institutions, such as the General Motors Institute at Flint, Mich., and the Bendix Safety Service School at South Bend, Ind.

There are two other important branches of technical training, the Medical Department, and the Finance Department.

From the first of these come the famous microbe hunters, unsung heroes who have saved millions of lives from malaria, dengue fever, and other scourges of humanity. The Medical Department embraces the Medical Service proper, the Dental Service, and the Veterinary Service. At the Army Medical Center in Washington, D. C., enlisted men can attend two courses a year for developing X-ray, laboratory, dental and veterinary technicians. There is also an important School of Aviation Medicine at Randolph Field, Tex. Graduates of this school become assistants to flight surgeons.

There is a vast amount of paper work in the army, and lots of money to handle. The Finance Department does it, and expert bookkeepers, accountants, cashiers, clerks, stenographers and other specialists are trained in the Finance School, at Washington, D. C.

Another technical branch is the Ordnance Department, charged with the maintenance of arms, where a high degree of skill in precision machine work is developed. The Ordnance Field Service School is at Raritan Arsenal, N. J.

\$200 My First Week



... Now in
**my OWN
Business.**

Would you, too, like to own a business where it is possible to take in as much as \$200 your first week as did L. A. Eagles in his new business?

We want a reputable, honest man in each county. This man need not have any special experience or more than ordinary ability, but he must be honest and courteous.

Such a man we will start in business for himself. You can make far above average profits in the rug-washing business—a high-grade business all your own. Many earn \$125 to \$200 per week—some considerably more.

NO SHOP NECESSARY

The rug-washer cleans rugs like new on the customer's floor. Anyone can run it. Electricity does the work. A quick, thorough and highly-efficient method that brings out the natural beauty of floor coverings.

There are hundreds of customers—in your vicinity and nearby towns. The business grows steadily. Simply wash a few rugs or carpets. These customers tell others and also give you their future work. Soon you will have a prosperous year-around business. Send coupon for booklet explaining everything.

"Profits Pay for Home"

Harry Hill built and paid for a home from rug-washer profits. His first day's business was \$86. Another man writes, "Made \$70 in 13 hours." A. L. Miller says, "Have had rug-washer 6 years—have earned as high as \$92 a day." M. O. Malmin earned 3 times the cost of his machine the first two months. You, too, can enjoy a large income.

VON SCHRADER MFG. CO., 102 PL., RACINE, WIS.

MAN IN EACH TOWN To Plate Auto Parts

Reflectors, Bicycles, Fixtures, Mirrors, by late method. Simple plan of manufacturing at home starts you IN GOOD PAYING BUSINESS. Write today for FREE particulars and proofs.

Ave. M

GUNMETAL CO.

Decatur, Ill.



CASH PAID Why not get ready now to spend spring, summer, fall outdoors gathering insects—butterflies, moths. I buy hundreds of kinds for collections. Good cash prices paid. Some \$1 to \$7. Easy. Simple. Send (do not stamp) for illustrated prospectus before sending any insects. Write today. Hurry!
MR. SINCLAIR, DEALER IN INSECTS,
Dept. 72, Box 1830, San Diego, Calif.



EASTERN SEED CO.
Dept. 26, Lancaster, Pa.

WRIST WATCH
Gorgeous Dinner Sets
20 Other Prizes Given
according to plan in catalog. **WRITE TODAY!**

Free Book! MAIL COUPON now

VON SCHRADER MFG. CO.
102 PL., Racine, Wis.

Send at once (no obligation) your free booklet illustrating rug-washer and telling how I can own my own permanent business; how I can earn large profits at prices below other methods; how I can become financially independent in a short time; and how I can pay on easy terms.

Name.....

Address.....

City.....State.....

"Never a Complaint"

C. J. White says: "\$100 business in six days—never a complaint." That is the nicest part of this business—every customer is more than satisfied. Stains and blotches disappear and vivid colorings and freshness in faded floor coverings come back.

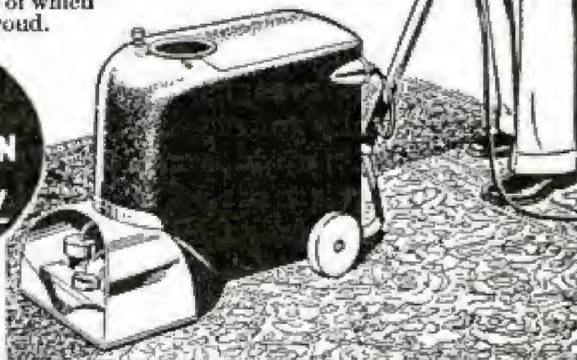
EVERY MACHINE GUARANTEED

You take no risk. These machines have been manufactured since 1918 and are used by the United States Government and by many of the world's largest hotels. They are fully GUARANTEED.

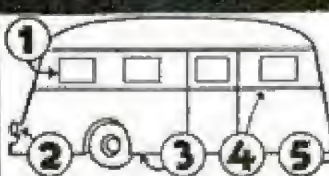
EASY TERMS

The complete equipment is inexpensive. A reasonable down payment brings everything to you and the balance is paid monthly. From the start, you have your own business—one that is profitable and of which you can be proud.

**MAIL
COUPON
Today**



"MARVEL-OUTS" TRAILER PARTS



(1) "Famous" Marvel Windows, (2) tail lights, (3) complete undercarriage equipment, (4) body moldings, (5) couplers. Also refrigerators, stoves, lighting fixtures, everything you need in highest quality. Largest trailer equipment stock in U. S. Immediate delivery, low prices. Send 10c coin for 40-page ill. catalog.

Marvel Trailer Parts Co., 19002 Celestine Ave., Detroit, Mich.



MAKE MONEY

WITH NASH CUSTOM TAILORED CLOTHES

Be your own Sales Manager, take orders; earn money with this famous make of clothes. High quality men's tailoring at popular prices.

WRITE! Write in today. Territories open.

THE A. NASH COMPANY

1913 ELM STREET • CINCINNATI, OHIO

Winning Races in the Pits

(Continued from Colorado Section)

Louis Tomei, another driver, couldn't believe his ears when the pit crew told him that the practice lap he had just finished was the fastest yet. He should have gone slower, for his motor had been badly tuned and had dropped 300 revolutions per minute. But when the pit crew had made the poor adjustment to the engine they had also put on new tires and these had slipped and skidded less in the turns, resulting in faster time around the track.

Most of the race cars are started from battery carts that are wheeled alongside. The three Joe Thorne entries are started by portable compressed-air motors that spin the engines, and Harry Miller uses blank shotgun shells. A cartridge is slipped into a special tube behind the engine and it makes a noise like a giant sneeze when it is fired, its pressure operating a piston that revolves the drive shaft.

Miller's new car looked like no other at the track and it was a revolutionary departure from standard design. It is a supercharged rear-engine four-wheel drive job individually sprung on all four wheels. The driver sits up in front behind the radiator. It requires special training to drive such a car and today Miller is training a group of men to drive in the 1940 race. Most drivers sense their speed by the sound and vibration of the engine, but with the engine and its noise behind him the driver feels he is coasting along. Unless he keeps an eye on the tachometer he is apt to hit a turn too fast. If he takes his foot completely off the throttle in a turn he is bound to spin. He has to keep using some power to keep the car pointed ahead. George Bailey drove one of the Millers until he was forced out at 118 miles with a broken valve lock, an identical car stood in the garage during the race because no competent driver was available, and a third was wrecked in practice.

In the rear-engined Miller the six-cylinder engine lies on its side at a forty-five-degree angle for proper distribution of weight. The engine has a speed of 7,400 revolutions per minute on stock gasoline, enough to average 130 miles per hour or better on the Indianapolis track. The bore is three and one-half inches, stroke is three and one-eighth inches, and the compression ratio is five-and-one-half to one.

There are seven main bearings and the connecting rods are tubular with steel-backed bearings. The aluminum cylinder block is one piece to above the valve ports, combustion chambers are semi-spherical, and the valves seat directly on the aluminum block for better cooling, a practice that is permitted by the soft cam action. The car has a positively locked clutch and a four-speed dry-sump transmission mounted in front of the engine. The transmission is lubricated by a spray of oil.

The supercharger is mounted behind the differential housing at the rear of the engine and works off a shockless planetary gear drive from the crankshaft. It spins at up to 36,000 revolutions per minute, operates under twelve to fifteen pounds pressure, and has a double impeller to prevent back pressure. An inter-cooler between the supercharger and the engine is mounted outside the body to bring the temperature of the fuel down from the 400 degrees at which it leaves the supercharger to about 178 degrees before it enters the combustion chambers. The car has hydraulic disk brakes of special design.

No "jallopies" are allowed to enter the 500 at Indianapolis. Half the time the best cars that men and science can devise fail under the grueling conditions of the race, and the hazard to drivers and spectators alike is cut to a minimum by the strict mechanical requirements of the inspection committee. Some of the cars cost fortunes, some cost relatively little, and there is no way to tell ahead of time which one will win. The driver gets the glory and the checkered flag, but he knows that the pit crew should get much of the credit.

Best Air for Gliding Is Found by Instruments on Wings

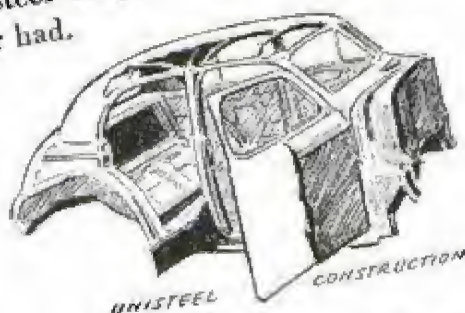
Glider pilots scouting around in the sky for favorable air currents can find them by watching a cockpit dial. A student at the University of Maryland has invented a "thermal gradiometer" which detects the thermal air currents on which soaring depends. Hairlike thermocouples are mounted on each end of the glider's wing to measure the temperature at the wing tips and the differential, shown on a dial, enables the pilot to find rising currents.

College Park, Md.

NOTES FROM A CRAFTSMAN'S HANDBOOK

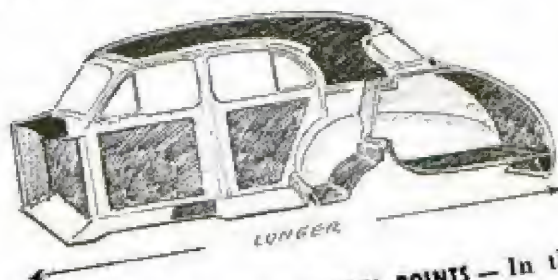
WHAT'S NEW IN THE 1940 BODY BY FISHER

Comparison of the new Body by Fisher with motor car bodies of the past shows a marked step-up in three basic characteristics: size, strength and visibility. It is actually the longest, widest, strongest Unisteel body General Motors cars have ever had.

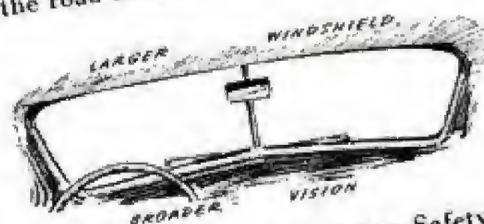


GREATER STRUCTURAL STRENGTH—New engineering at principal points of strain makes the entire Unisteel structure more resistant to weaving and shock. For instance, there are stronger steel support rails overhead and at floor level; longer roof-rails with new reinforcements; new double steel panels in the rear quarter sections; and a higher crowned steel Turret Top.

"In 1940, it's Pontiac for Pride and Performance," and in its brilliant new Body by Fisher are many of the big reasons why. What's more, for the Pontiac Torpedo 8 pictured here, it also provides new safety — by the use of stronger Hi-Test Safety Plate Glass not only in the windshield, but in all door windows and Ventipanes, too.



INCREASED DIMENSIONS AT VITAL POINTS—In the Pontiac 8 illustrated, both the lateral and longitudinal dimensions are carried well beyond previous limits to give greater roominess and more graceful contours. The overall length has been substantially increased — as has the width at the center pillars. In addition the windshield is now wider and the back window 18% larger — thus extending the view of the road ahead and behind.



CLEARER, SAFER VISION—Genuine Safety Plate Glass eliminates the distortion waves produced by ordinary safety "window" glass — reduces eyestrain 62%.

Clear, distortion-free Safety Plate Glass is used not only in the windshield, but throughout — for the better visibility of all passengers, in all 1940 General Motors cars.



BODY BY

Fisher

ON GENERAL MOTORS CARS ONLY:

CHEVROLET • PONTIAC • OLDSMOBILE
BUICK • LA SALLE • CADILLAC

America's Dinner Rides the Rails

(Continued from page 244)

sachusetts cranberries travel to western states as fresh and crisp as they are at home.

California is the country's largest vegetable garden and fruit orchard. One-third of all fresh fruits and vegetables that are shipped to other markets originate in that state. The Pacific Fruit Express company, operated jointly by the Southern Pacific and Union Pacific, with headquarters in California, last year handled 40,571 cars of lettuce of more than 300 crates each or ninety-three per cent of the country's total production. The carrier hauled 64,144 cars or thirty-three per cent of all other vegetables and 56,701 cars of citrus fruits. In all, the company and its owners transported thirty-four per cent of all rail shipments of perishable foodstuffs in the United States.

Among the things that make the refrigerator business a complicated one is the fact that crop movements depend on news and that the news changes every day. A shipper tries to consign his cars to the best market and among other things he has to know the number of cars on hand at the different terminal markets, the present wholesale prices, the condition of the markets, and the weather at each point. This and other information is gathered daily by the Department of Agriculture and is furnished by wire and radio to local offices in the growing districts.

Most shipments leave the fields with no definite destinations. A trainload of cauliflower, lima beans, and peas from California may be routed to some point in New Mexico or Texas and then broken up as the strengths of different markets show the demand. Sometimes while a trainload of fresh vegetables is en route to New Hampshire the market falls and the load is hauled back to Indiana. Again the market may fluctuate and, after a number of diversions, the train may once more be sent to New Hampshire or finally delivered to wholesalers in Georgia. Nearly 1,000,000 such diversion orders were handled last year by Pacific Fruit Express. Many vegetables reach the consumers ten days or less after starting a transcontinental trip. Some crops, kept properly iced, can be held in good condition materially longer.

More than five tons of ice are usually loaded into the end bunkers of a "reefer" before it receives its cargo. After being loaded it is returned to the icing point for replenishment and thereafter it is re-iced at designated points along its journey. Pacific Fruit Express is apt to consume 2,000,000 tons of ice yearly at the several hundred icing platforms it uses.

Lettuce and other leafy crops are smothered in crushed "snow ice" blown into the car. The amount and size of the ice chunks used to cool other foods depend on the crop and the temperature at which it is to be maintained. Certain crops are pre-cooled to remove their field heat before they are shipped, and others are shipped in semi-ripe condition so that they can finish their ripening process en route and be at the peak of condition when they are placed on sale. In pre-cooling a loaded car a constant draft of cold dry air is forced into the car, the pre-cooling requiring from four to forty hours, depending on the commodity and load.

In the winter citrus fruits are ordinarily ventilated instead of refrigerated, car ventilators being opened while the outside temperature remains above thirty-two degrees and being closed when the weather becomes colder. Other delicate crops occasionally require heating when the weather is too cold although the insulated cars are a good protection against outside weather changes. Sometimes during a cold spell trainloads of vegetables must be held intact at Chicago and other northern points until the weather abates. Otherwise the foodstuffs would freeze while they are being unloaded. Brine and salted ice furnish the lower temperatures required for transporting meat and fish. Fast-frozen products are carried in super-insulated cars that have been cooled down to low interior temperatures.

Today fresh fruits, vegetables and other perishables move on train schedules materially faster than a decade or so ago and with far more dependability.

☛Inquiries as to makers of articles described in Popular Mechanics will be answered by our Bureau of Information upon receipt of return postage.

"I WAS TRAPPED IN A BLAZING INFERNO!"

A true experience of MRS. LILLIAN POKEDOFF, Brooklyn, N. Y.



"AN OMINOUS, CRACKLING NOISE awoke me the first night I was visiting in a strange farmhouse," writes Mrs. Pokedoff. "Choking and coughing from smoke, I groped for the bedroom door and staggered out into the hall."

"IN THE THICK, BILLOWING SMOKE I couldn't locate the stairway. Then I heard a muffled shout from below and a beam of light bored through the darkness, showing me the way to safety."



"I STUMBLED DOWN THE STEPS just in time—for a kerosene tank exploded and the house burned to the ground! I sincerely say that I owe my life to those powerful and dependable 'Eveready' fresh DATED batteries!"

(Signed) *(Mrs) Lillian Pokedoff*



FRESH BATTERIES LAST LONGER... Look for the DATE-LINE

NATIONAL CARBON COMPANY, INC., 30 EAST 42ND STREET, NEW YORK, N. Y.

Unit of Union Carbide and Carbon Corporation

SEND FOR THIS
FREE 204
PAGE
RADIO
AND PARTS
CATALOG
See AMERICA'S Most
AMAZING RADIO VALUES!

Dealers, Servicemen, Amateurs, P. A. men, Builders save money on every radio need! This famous catalog brings you Everything in Radio at lowest prices!—sets, parts, kits, tubes, tools, ham gear, P. A. systems, phonographs, recorders, test equipment—over 15,000 items! Save money on every order! **FREE—SEND COUPON!**



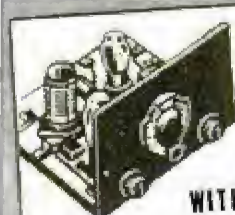
Choose from 60 MODELS

A set for every need at great money-saving prices—60 different models, 4 to 12 tubes, with newest features, "Air-Magnet", etc., at lowest prices—with biggest values in electric phonographs, phono-radios, etc. All shown in ALLIED's big 1940 catalog—Send coupon!



REVOLUTIONARY! NEW P. A. SYSTEMS!

Remarkable values in P.A. systems for every need—14 sensational new systems, "Economy," "Standard," "De Luxe," 6 to 70 watts. Also latest accessories, complete recording equipment, etc., at lowest prices—in ALLIED's Catalog. New Time Payment plan!



Learn Radio
BUILD YOUR
OWN
WITH ALLIED KITS



Build your own radio receiver, transmitter, transceiver—learn while you build! Dozens of new, low-cost, easy-to-build kits are shown in ALLIED's Catalog. We supply Free, matched Parts lists to build any circuit. Learn Radio quickly—enjoy this great hobby! ALLIED helps you learn easily!

Send for RADIO BUILDERS' HANDBOOK—A beginner's book on radio; tells how to select circuits, read diagrams, cuts, read diagrams, build sets, etc. Easy to understand. Packed with helpful data. New revised edition. **10c** Only. Order by coupon below.

ALLIED RADIO

833 W. Jackson Blvd. Dept. 5-BB-0
Chicago, Illinois

- ☐ RUSH your FREE 1940 Radio Supply Catalog.
☐ ENCLOSED find 10c. Send your NEW Radio Builders' Handbook.

Name.....

Address.....

City..... State.....

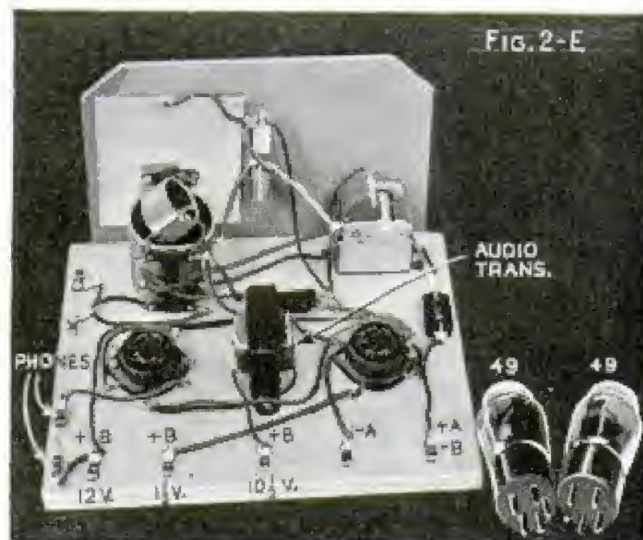
CATALOG
FREE
Send this
Coupon!

Two-Band Flashlight-Battery Set

(Continued from page 297)

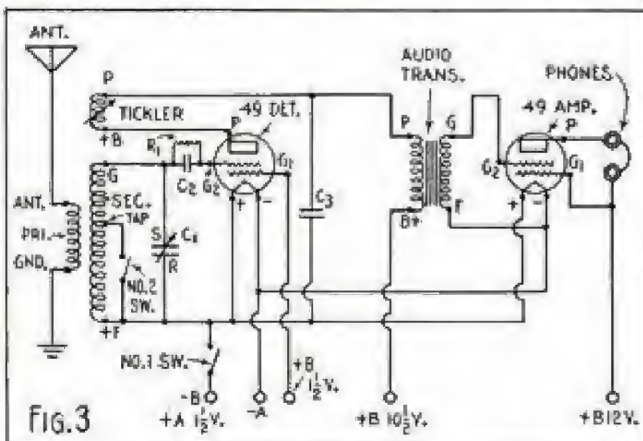
of the variable condenser is common with the rotor or "movable" plates. C_1 may be either .00035 mfd. or 365 mmfd.

A large $1\frac{1}{2}$ -volt dry cell A-battery will furnish several months of intermittent operation. The flashlight B-battery will be good for almost a year, if large flashlight



batteries are used. A detailed list of materials can be obtained from Popular Mechanics radio department without charge.

To operate the receiver, use a good pair of 2,000-ohm headphones; connect a ground lead to a cold-water pipe, and use a good outdoor antenna. In tuning,



turn "on" switch No. 1 and rotate the movable tickler coil until it is all the way "in." Next turn the variable condenser until a whistle indicating a station is tuned in, and rotate the tickler coil until the whistle stops. Always keep the tickler to a point where the phone stations are tuned in without a whistle. For short-wave reception, switch No. 2 is snapped to "on" position. The tuning procedure is the same. Blueprint number for this article is R-275.



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Power Cross Feed Standard Equipment

Whatever the Job... These Features Help You Do It Easier and Better!

You buy a lathe with definite things in mind: Precision workmanship—simple, convenient operation and complete versatility—dependable, long-life construction. And price is usually important. In all these respects you'll find experienced machinists advising—"Get the modern Atlas." Here are some of the reasons why:

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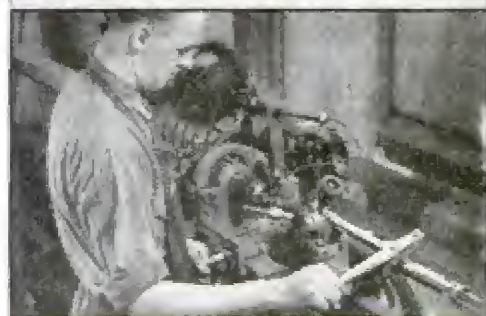
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THE OHIO CULTIVATOR CO.,
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Electrical Recording

(Continued from page 298)

and playback instrument are shown in photos Figs. 1 and 7. The cutting head with its adjustable arm is clearly shown in photo Fig. 3. Also available with this basic mechanism is the 4-tube audio amplifier which appears in photo Fig. 4. However, some experimenters prefer to build their own high-fidelity, low-hum-level amplifiers. The recording amplifier shown has a distortionless output of 4.2 watts and an extremely low-hum level; it also may be used as a public-address amplifier in addition to a recording amplifier, if desired. A crystal microphone with good frequency range and high output is recommended; crystal microphones of this description are shown in photos Figs. 5 and 7. The one



illustrated in Fig. 5 has the advantage of a side cable outlet and connector plug arranged so that a longer shielded cable may be used when the amplifier is employed for public-address service.

With well designed recording apparatus of this description it is possible for anyone to make high-quality recordings to meet practically any purpose. Recording music and radio programs broadcast on the foreign short-wave bands, addresses of famous speakers, sound accompaniment for home movies, also greetings for every occasion and personal messages that your relatives and friends can reproduce through any modern a.c. receiver by means of inexpensive record players of the type shown in photo Fig. 6, are a few of the interesting applications in the home. In schools and colleges this type of recorder is employed in the study of speech, languages, music and public speaking.

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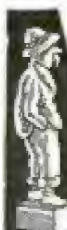
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21054

There's Magic in Everything

(Continued from page 203)

small bead or ring. One end of the string is knotted to this, the other goes through a suspended ring and out the top of the tube. A second string is attached to the suspended ring, the end of which the performer holds. When he wishes the tube to rise he merely tightens the cord, or, if the tube is to go down, the string is held limp. In handing the tube to the spectator, the magician turns it upside down. This causes the tube to dangle at the end of the cord, where it can't move.

An absorbing bit of dinner-table hocus-pocus is the pouring of smoke from one glass to another. With six or seven puffs of cigarette smoke, fill a freshly emptied water glass to the brim. The smoke should be pushed out of the mouth gently with the tongue so it's folded rather than blown into the glass. As soon as the glass is filled, bring it in contact with the rim of a second moistened glass and tilt slowly; the smoke will roll from one to the other as if it were a liquid. The pouring operation can be repeated several times, but be sure the two glass edges are brought together as a small air current blowing between them is apt to dissipate the smoke.

A concluding trick with numbers is the telling of a person's age and his street number by a series of commands. The person writes his street number on a sheet of paper shielded from the magician's gaze. His next command is to double it, add five, and multiply the total by fifty. To this amount he adds his age. The last command is to add the number of days in a year to his total and subtract 615. The last two figures will be his age, the others his house number.

With scissors and bond paper you can fashion a walking doll, which can be made to walk backward or forward on a table top to the wonderment of young and old. Blow gently against the doll and it will "retreat." Hold your hand behind the doll, blow against your hand and the doll walks toward you.

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Radio Goes to War

(Continued from page 213)

channels to RCA Communications, the receiving point at Riverhead, Long Island. Thence they were transmitted by wire to a master control room in Radio City, located in New York, and finally by wire lines to stations scheduled to receive the broadcasts. From these local stations the news was transmitted on regular wavelengths to listeners. Broadcasts from other foreign cities, such as Warsaw before its fall, which do not always have dependable direct transatlantic short-wave facilities, were sometimes wired to Geneva, Paris or London and then short-waved across the ocean to diversity receiving units at Riverhead. A diversity unit comprises three receivers, each of which is equipped with an automatic gain control. The strongest of the three receivers automatically feeds the line amplifier, the output of which goes by wire to the master control room. Thus, if one of the signals becomes too weak for dependable U. S. reception, another receiver goes into action automatically.

Most of the foreign talks are arranged well in advance of the actual broadcast. Should a commentator have something important, he radiograms the special events department, which is directed by A. A. Schechter, telling when he wants to go on the air, and transatlantic and local channels are cleared for him.

During the days just preceding the war, NBC's special events department was a chaos of wires, microphones and technical equipment. Events moved so fast that a miniature master control room, with monitoring facilities and all, was established there in order to expedite broadcasts. A twenty-four hour day was in effect for most of the personnel; sandwiches and coffee comprised the diet of most of the staff for a full week, with the result that in the ten days preceding outbreak of hostilities more than 150 foreign broadcasts were brought to American listeners by NBC.

Technically the war has been marked by Columbia's use of a four-way hookup, which renders possible conversations on the same program between experts in New York, Washington, Paris and London. When CBS technicians tackled the problem of giving American listeners a bal-

(Continued to page 139A)

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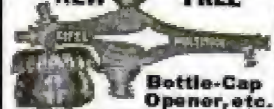
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Dept. 240, 200 E. Ontario Street, Chicago



(Continued from page 137A)

anced picture, in one program, of the situation as it developed in world capitals, a four-way conversation required the use of several short-wave channels and cue channels. To eliminate the multiplicity of channels, the staff developed a complicated arrangement of circuits and amplifiers whereby each man on the program could hear the voices of every other man, but not his own. If his own voice had been audible, the slight time lag would have destroyed the clarity of the program. But more important, it was possible to carry the entire program on two channels, one eastbound and one westbound.

Dress rehearsals for the European coverage had been held by the broadcasting companies in the form of broadcasts of U. S. Army maneuvers. In these sham battles, one announcer carries a pack transmitter, weighing perhaps twenty-five pounds, on his back and does most of the talking. Behind him, in a mobile unit, is an engineer and a few miles away, in a tower, are stationed a few observers commanding a view of much of the "battle" front. Their position compares with that of an observation balloon in a real engagement. Other staff men, many of them Reserve Corps officers, are stationed at various strategic points—at General Headquarters, in observation planes, around the battlefield—while others perform the duties of liaison men. The announcer, with his one or two-watt pack set, transmits signals, while the "battle" rages, to the mobile unit, which is equipped with a transmitter, of perhaps twenty-five-watts power. From there the signals are retransmitted to a seventy-foot tower far back of the lines and operated around 2,000 kilocycles. The signal then is picked up by a receiving station located at General Headquarters and retransmitted once more to a central control station, thence by special telephone circuit to the master control room where it is fed to the networks. By using several wave lengths the engineers are able to avoid concentration of interference on any one channel by the hundreds of transmitters being used by the opposing "armies."

Broadcasts of army maneuvers have demonstrated that radio coverage of a single engagement between Germany and the

(Continued to page 140A)

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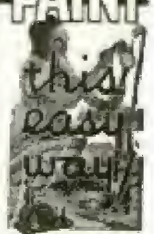
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No previous experience in any kind of selling is necessary. If you are capable of understanding and of applying your own judgment to tested methods, if you are one who likes to practice to gain skill and judgment in what he does, and if you are a worker, willing to pay a working price for success, then we will give you a chance. We cannot guarantee you will be a star, but we do guarantee you opportunity with sincere, earnest, practical instruction and guidance.

This is a large national institution operating from coast to coast. Soundest backing. Starting with 1 office 15 years ago, now hundreds of offices required. Significant Sign: Biggest progress made during past 10 years. We are now introducing this extraordinary product and it already has a greater sale than any product in the world ever attempting any of its services (no device ever having attempted to render all of its services).

Only for Men Interested in PERMANENCE

Do not misunderstand. This is no get-rich-quick scheme. You cannot make money here unless you earn it, and some men who apply to us fail to fulfill the requirements. But we have found also that many men who never previously even thought they could do work of this kind have found it to be just the opportunity they sought for years, and are now making more money than they ever previously dreamed of making. We have men making up to \$500.00 a month or more. Others \$100.00, \$300.00, \$250.00.

No previous experience necessary. If you are intelligent and capable, a responsible man willing to pay a working price for success, Electrolux Corporation will give you the same opportunity.

Can You Meet These REQUIREMENTS?

To be accepted, you must be able:

- 1.—To furnish 3 good character references.
- 2.—To prove, if unemployed, it is not through any fault of your own.
- 3.—To point to past record of activity and diligent application.

No investment or charge of any kind; all training is free; necessarily we must use care in appointing applicants.

PLEASE GET THIS: We realize a man of average ability must MEET SUCCESS FACE TO FACE, see it work, personally, IN HIS LOCALITY, before he can proceed without doubt or fear. Therefore the first step is a personal interview, followed immediately by your direct observation of sales success in actual operation.

You could read descriptions, claims, outlines, bulletins, courses for months and not KNOW as much as you can find out in ONE DAY about actual, successful procedure—applicable at once, since the visual way of showing overwhelming value is in itself simple yet powerful.

Then only can you understand (or accept) published earnings of

\$2,500, \$3,500, \$5,000, \$7,500, \$10,000

or more per year. Not by wondering about it—it is necessary to MEET MEN who do it, and SEE HOW they do it.

We recently published a list of earnings of 10 men making \$9,403.29 for the previous month, an average of \$940.32 per man for the month. We realized many would not see it, some would feel doubtful about it, a few would seriously investigate for themselves.

The results for 10 such men making a serious investigation are, TO THE PENNY:

MR.	FORMERLY	EARNED FIRST MONTH
C. F. N.	Burial Pk. Dir.	\$130.95
Fred H.	Mill Worker	243.86
S. S.	Factory Worker	190.55
R. J. F.	Salesman	402.64
D. G.	Bookkeeper	127.50
J. N. Mel.	Barber	93.05
F. S.	Farmer	116.86
P. M.	Store-keeper	126.47
J. B. G.	P.W.A. Worker	135.64
G. McD.	Grocery Clerk	169.33

The results for 10 experienced men are, TO THE PENNY:

MR.	FORMERLY	EARNED SAME MONTH
C. S. G.	Office suppl.	\$ 781.87
J. T.	Brush Salesman	993.04
Dan Y.	Bus Driver	618.90
J. K.	Laundry route	627.55
Joe P.	R. R. shop	954.91
Wm. S.	Dept. store	1314.13
Cyril R.	Radio Engr.	1103.60
E. A. L.	Salesman	1324.30
M. M. H.	Real Estate	1071.21
Rob't. L.	Machinist	1261.50

We can use good men who mean business and show them a fine opportunity already tested and working out successfully for other men—men of good character who work hard every day—who are buying homes, new cars, new furnishings, putting money in the bank regularly—mutually helpful and successful. If you feel you could fit in with men of this caliber and would truly appreciate seeing how they do it, write to **DEALER FRANCHISE DEPT., ELECTROLUX CORPORATION, 500 FIFTH AVENUE, NEW YORK CITY** stating name; address; age; if idle, how long, and why? Previous occupation and earnings; family status; dependents. (Not a mail order proposition—Personal interview in your own locality necessary.)

21188
(Continued from page 139A)

Allies might run into countless thousands of dollars. In the first place the best of short-wave and ultra-high frequency transmission paraphernalia must be put into action. Second, a battle cannot be counted on to occur within the vicinity of the mobile transmitters, and third, a miniature radio army must be used for speedy and efficient coverage. But in the face of tremendous expense and untold mechanical difficulties, the broadcasting companies are ready to undertake battlefield broadcasts. If and when the censorship is lifted by the warring powers, you'll be able to tune in the voice of the big guns.

21090 How Long Can Germs Live?

(Continued from page 239)

proof that organisms have remained dormant for periods up to 5,000 years. Other experiments indicate they can withstand freezing, that they exist high in the stratosphere where the temperature is seventy degrees below zero.

Years ago Dr. Bartle conceived that it might be possible for single-celled organisms to sink into a dormant state in which they would remain potentially alive. Obviously, the only sure proof would be to find something which once contained bacteria, but which had been protected from further contamination and from growth for an extended length of time.

"When I first told people about my theory," Dr. Bartle admits, "the whole thing sounded crazy—even to me. But although I didn't have much hope of succeeding, I decided to try."

A few blocks from Dr. Bartle's home in San Luis Obispo, Calif., was a Spanish mission built in 1775. Some of the basement walls had been untouched since they were constructed. They were several feet thick, made of sun-baked brick, and dry as a bone. These walls seemed ideal for Dr. Bartle's experiment. It was only necessary to devise a method by which material could be removed without contamination from outside sources.

After much experimentation he devised a technique so foolproof that he has continued to use it during hundreds of other experiments. First step in securing a specimen is to flame the surface with a blowtorch until it glows ruby red. Next it is

sprayed with a fifty-per-cent solution of phenol, a powerful disinfectant. Then a hole is bored three or four inches into the material. The hole is also flamed and sprayed with disinfectant. Then a small coring auger is inserted into the hole, care being taken that it does not touch the sides. With the coring auger specimens are taken from various depths. These specimens are placed in sterile test tubes by means of a sterile glass rod. All tools are sterilized before use, and carried in sterile towels. Should they touch anything that has not been sterilized, they are flamed with the blowtorch.

The cores of material taken from the old mission wall were placed in test tubes that contained sterile bacterial media, which



Test tubes filled with germ-laden material were frozen a year in ice then thawed and germs revived

supplied food and moisture for any organisms that might have survived since the year before the American Revolution—the date when the mission wall had been built. The next day Dr. Bartle looked at the test tubes. Nothing had changed. The following day there was still no change. On the fourth day, a slight milkiness, a touch of turbulence, showed in one of the tubes.

Half wild with excitement, Dr. Bartle placed some of the culture beneath his microscope. Before his eye swam millions of moving—living—organisms; organisms which had survived without moisture, air, or food for almost 200 years.

His hand still wasn't steady when he wrote on the chart:

(Continued to page 142A)

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SHAKESPEARE CO., 237 E. Kalamazoo Ave., Kalamazoo, Mich.

(Continued from page 141A)

"Ninety-six hours—thirty-seven colonies of living bacteria."

From then on Dr. Bartle was determined to establish whether there was any limit to the time which bacteria might remain dormant. He traveled thousands of miles searching for ancient structures which complied with the rigid conditions he laid down. Twice he crossed half a continent, only to find that the structure from which he hoped to take specimens had not been sufficiently protected from contamination.

But year after year he continued to secure older and older specimens, and in every case bacteria grew and flourished in his test tubes. Professor Charles Lipman of the University of California became interested, verified many of his results.

And then, deep in the age-old Teotihuacan Pyramid of the Sun, in Mexico, he found exactly what he had sought. Here was a structure whose age was not measured in centuries, but in millenniums. His blowtorch roared as he flamed a wall built 5,000 years before. And from this material, sealed away before the time of King Tut, he revived hundreds of colonies of bacteria.

Next Dr. Bartle heard that a National Geographic Society expedition had taken living organisms from the stratosphere, under conditions as nearly contamination-proof as humanly possible. These organisms, bacteria and spores, appeared to have been floating in the rarefied air where the temperature was seventy degrees below zero—and they had revived when placed under favorable conditions.

To further check the theory that bacteria could remain dormant in extreme cold, Dr. Bartle froze several test tubes full of organisms, kept them frozen for an entire year, then thawed them out. They promptly came back to life.

From these facts has come a new theory concerning the sudden appearance of epidemics of disease. If germs can be carried high into the stratosphere, they might remain for centuries at that high altitude, kept dormant by the low temperature. Then a strong down wind might carry them back to the lower atmosphere, where moisture and higher temperatures would cause them to spread a sudden epidemic.

It's still only a theory. But it explains a lot of hitherto baffling facts. And since Dr. Bartle has proved that bacteria are potentially deathless, the idea isn't so absurd.

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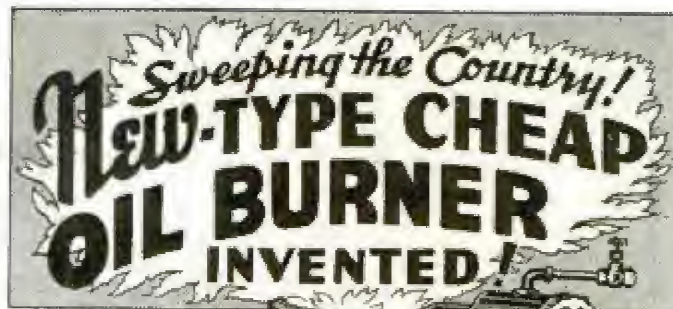
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Reduced coal bill fifty percent.—**W. S. Collins—Pa.**



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Army on Wheels

(Continued from page 221)

will be seen that the addition of one of our motorized infantry brigades to the 7th Cavalry Brigade would fill the bill.

It is a comforting thought to Americans that our youth are brought up in a motorized atmosphere; that mechanical ability is latent in them. Few and far between are the young Americans who cannot drive a motor vehicle, who cannot almost instantly grasp simple mechanical problems. Now the driving of a tank or combat car is much more difficult and complicated than tooling an automobile or truck. But the man who



Barrier of the type which has been found successful in stopping advance of tanks

can do the latter is prepared to learn rapidly the minutiae of the former. The present increase in our regular army is bringing a great demand for men who can operate motor vehicles of all types, not the least being for service in the swift-moving tanks of the infantry, the combat cars and half-tracks of the cavalry, the rapidly rolling trucks that pull our field artillery along the road at high speeds.

This demand is accentuated by the necessity for duplicate crews of motor vehicles. The army has found out that for long motor marches both drivers and assistant drivers must be shifted for safety's sake as well as for necessary relief from strain. The tired assistant driver may nod to sleep just as dangerously as the tired driver, with equally fatal results.

All of which brings us right back to our initial premise that although this is a mechanical age, machines are run by men, and men fight wars. Man is the director, the machine his servant.



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If your hair is causing you this kind of trouble and it is due to poor blood circulation in the scalp, rent a Crosley XERVAC and try home treatments with this amazing machine. It is designed to help correct just such conditions of the scalp as the lack of proper blood circulation.

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Wonder "Food" for Plants

(Continued from page 165)

mately one milligram. An ordinary toothpick will do nicely as an instrument to measure this small amount of crystals. Place the tiny spot of the vitamin in a clean vial and add twenty drops of water. This is your stock solution. Do not make up any more than you need, and keep it in the icebox. If kept cold, it will retain its strength for at least a month; when warm, it deteriorates quickly. The dry crystals will keep indefinitely.

To make a working solution, use one drop of the stock solution to each gallon of water in your sprinkling can. Water plants in the usual manner, and give the same amount of vitamin-treated water that you would of untreated water. For most plants a vitamin treatment once a week is ample. For roses and gardenias the application should be made twice a week. House plants also should be treated twice a week. Lawns should be treated once a week.

However, when you are treating a plant to prevent root shock during transplanting, you should use a stronger concentration. In this case twenty drops of stock solution should be mixed with one quart of water. The roots of the plant being transplanted should be cleared of dirt and soaked for twenty minutes in the solution. Then plant in the normal way, pressing dirt well around the roots. The solution in which the roots were soaked should then be used to water the plant. Use enough to give a good soaking.

In wet climates potted plants are the best subjects for your first experiments in vitamin feeding, as excessive rains immediately following vitamin feeding are liable to wash away the chemical from the roots of out-of-door plants. This, of course, does not apply to root-shock prevention treatment. In soils very rich in humus, vitamin feeding may be less successful. Gardeners working under such conditions should check their results carefully. Above all, be accurate in measuring and administering the solution, and keep up regular systematic treatment.

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No Brush • No Lather • No Rub-in

21230

It's Easy to Fly Your Own

(Continued from page 171)

thousands of miles. The first Cub ever built is still in use, after flying more than 250,000 miles, nearly 3,400 hours, and lightweight aircraft engines have a life figured at 4,000 to 6,000 hours, if given normal care. A recommended practice is to have the engine checked over at twenty-five hour intervals by a licensed mechanic. A fee of five dollars for this work is usual.

One curious thing about the plane is that the more you fly in a year, the lower the average cost per hour and mile. For instance, the owner of an "Aeronca" flew every day for twelve months, in all kinds of weather. At the end of that time, his log showed a total of 618 hours in the air and a mileage approximating 44,800 miles. His cost figures were: gasoline, 1,845 gallons, \$415.13; oil, thirty-seven gallons, \$35.15; engine and plane overhaul, \$25.60; total \$475.88. Adding depreciation, figured as \$300, and hangar rental, \$100, to that amount gives a total expense of \$875.88, or just under two cents per mile.

In comparison, an automobile costing as much as the "Aeronca" and traveling the same distance would have called for an expenditure of approximately \$1,400 for depreciation, garage, gasoline, oil, lubrication, tires and engine repairs and replacements. If the car averaged forty-five miles per hour, it would have required 996 hours to travel the 44,800 miles flown by the plane. Thus you have a saving in money and in time. Naturally, the plane cannot displace the auto. Both have their particular jobs and the owner of a plane would be wise to have a car in which to travel between the airport and his home, or on short trips. The plane comes into its own for journeys of 100 miles and more.

An outstanding air trip was a non-stop flight covering a distance of 2,785 miles. The ship was an "Aeronca." Cruising at ninety-one miles per hour, the flight required \$25.70 worth of gasoline and oil, less than one cent per mile, a record that cannot be equaled by the average low-priced automobile. Of course, the saving in time over that which the auto driver would have needed is considerable.

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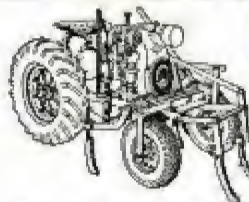
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WELL-GROOMED MEN

Do your own Pressing this modern way, at home, in office or when traveling. Easy to use. No wet cloth, board or boiler. Plug in any socket and it's ready to press pants, collars, sleeves, lapels, dress pleats. And man, what it does to crumpled ties! It presses them into crisp newness before you can say Jack Robinson.

\$1 Post-Paid Money Back Guarantee.



Material slides between two electrically heated pressing blades. Saves time, money, wear on clothes. Don't let another day go by without an Empire. Send the coupon now. And remember it's a gift any man or boy will appreciate. Each Empire presser is fully guaranteed. Comes complete with cord, plug, and simple directions.

DEALERS—Over 750,000 sold to date. Order now to take care of growing demand everywhere.

EMPIRE ELECTRIC CO., Dept. PM 817 Main Street, Cincinnati, Ohio

PM-2

Enclosed is \$1.00 for an Empire. If not satisfied, I will return it and my money will be refunded.

Name.....

Address.....

81230

eight hours flying time, at an approximate average speed of ninety-eight miles per hour, and touched seventeen states. Here are comparative figures for the plane's trip and what an automobile would have required (figures for the car supplied by the Michigan Automobile Club):

	"105"	Auto
Distance by air	7,590 miles	9,230 miles
Distance by road		237.5 hours
Time for trip	78 hours (approx.)	40 m.p.h.
Average speed	98 m.p.h. (approx.)	\$109.61
Cost of gasoline	\$93.72	\$10.00
Cost of oil	\$4.56	

Night storage of the plane and of the auto would have cost approximately the same. Overnight hangar fees range from one to two dollars.

The Stinson is more expensive to buy than the average automobile, but over a period of time this difference probably would be reduced to a minimum by the cheaper operating costs of the airplane.

The more money a prospective airplane purchaser is willing to spend, the more he gets—more horsepower, more interior space, more instruments and more luxurious appointments. The \$995 Cub, powered by a forty-horsepower engine, might be called the "Model T" of aviation, since it offers perhaps the utmost in air-travel economy. From that point prices range upward, Aeroncas, Funks, Taylorcraft, Luscombe and a few other ships being offered at less than \$2,000. The Stinson "105," listed at \$2,995, goes a step farther, showing the performance characteristic of many of the larger and more expensive planes without the same high operating costs. What might be regarded as a deluxe job is the Waco "N," a four-place cabin ship with tricycle landing gear—considered a valuable contribution to safety—a powerful motor that develops a cruising speed of 140 miles per hour and luxurious seats, interior fittings and instruments. The price is \$10,695.

Undoubtedly there are many air-minded people who will say:

"Yes, I'd like to fly, but I don't have enough money to buy even the smallest plane, if it costs \$1,000 and if I have to pay \$250 to \$300 per year operating and maintaining it."

There are two ways in which such a person's yearning to fly can be satisfied. The first is to join a flying club, of which there are several hundred in the United States,

(Continued to page 149A)

Try this cooler SHAVING CREAM at our expense 20 SHAVES FREE

We won't ask you to read a lot of weighty arguments aimed to convince you that Listerine Shaving Cream is superior to others. We'll rest our case on the cream itself. We want you to try it at our expense.

One little dab of it on the face, whipped into a cool, creamy lather, will do more to convince you of its merit than a whole page of arguments.

If twenty free shaves do not remove all doubts of its superiority, nothing will.

It has been our experience that when a man gives Listerine Shaving Cream a thorough trial, he rarely returns to other brands—good as they may be. Possibly you will be an exception. We hope not.

It costs you nothing to learn the secret of cooler, quicker shaving. Simply clip the coupon below and put it in the mail. Tear it out now before you forget it. In return for it, you will receive a generous trial tube of Listerine Shaving Cream—enough for at least twenty shaves.

When that tube is empty, you will probably want the regular size tube. What a whopper of a tube it is . . . containing at least 130 shaves! Some men get as much as 175. What a whale of a bargain at 35¢!

All drug counters have it, as well as the new Listerine Brushless Cream. LAMBERT PHARMACAL CO.



LISTERINE SHAVING CREAM

20 SHAVES FREE

Lambert Pharmacal Co., Dept. 153, St. Louis, Mo.

Please send me free and postpaid your large sample tube of ☐ Listerine Shaving Cream; ☐ Listerine Brushless Cream. (Check whichever is desired.)

Name _____

Address _____

City _____ State _____

I'M SO HAPPY NOW
THAT CHARLES IS
DOING SO WELL IN HIS
NEW BUSINESS



**MADE \$217
in 10 DAYS
WASHING WALLS**

● Newly invented machine washes walls 6 times faster and better than by hand.

Charles Steele made \$217.00 the first 10 days. We want more men like him to go into business for themselves. Customers everywhere — homes, schools, offices, stores, churches, lodge halls, hotels all have walls that need washing. You don't rent a store or office; you operate this business from your home. On a job paying you \$10 your cost is 20c. Write for complete facts on new Von Schrader Wall Deterger which washes paint perfectly and postpones repainting many years.

Howard James writes: "I landed a \$40.00 job the first day."

J. A. Crosby says: "I have several jobs to start on Monday, thanks to your help."

Cliff Brown writes: "I got a contract for a public school which will more than pay for my machine in the next few days."

VON SCHRADER



Easy Payments

It takes only a few dollars to get started in this new money-making profession. No experience necessary. The total price is so small and the payments so easy that anyone with ambition should get started NOW.

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Start Your Own Business



with revolutionary new
**PHOENIX RUBBER
MAT MAKER**
Part or full time. Turn out
mats in 10 minutes
150% to 200% Profit.
Start on "Shoestring"

It's the "business opportunity of the year"! Actually you can earn back your investment the very first week! Phoenix Live Rubber Mats are the sensation of the hour—and "easy as playing checkers" to make. We supply everything. And in their striking color patterns, the finished mats are really beautiful. Sell homes, clubs, stores, public buildings, hospitals, funeral directors, etc. Super quality—yet at prices competition can't meet. Start spare time—expand. Big possibilities for growth! Act quick! Send 10c at once for complete money-making facts and "fortune test" samples. "\$50.00 a week and independence."

ing color patterns, the finished mats are really beautiful. Sell homes, clubs, stores, public buildings, hospitals, funeral directors, etc. Super quality—yet at prices competition can't meet. Start spare time—expand. Big possibilities for growth! Act quick! Send 10c at once for complete money-making facts and "fortune test" samples. "\$50.00 a week and independence."

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LEVEL STOVES, PLUMBING, CLOCKS, etc.

New Aluminum Cigar shaped level. Won't tear pocket. 9" long. Shows plumb, level, 45°, 1/4°; 1° pitch. Grooved Bottom. Only \$1.25.



BEAUTIFUL CHROME ALUMINUM POCKET LEVEL

Clips to Vest pocket like a fountain pen. Always handy. Accurate. Pitch graduations on level vial. Only 75c. Order direct or from your dealer. Send 10c for catalog. Empire Extreme accuracy level used by good craftsmen everywhere.



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GUARANTEED ACCURATE. Not a toy. Operates with only a finger flick. Adds, subtracts, multiplies, divides. Counts up to a million. Pays for itself over and over. Ideal Gift—for Business, Income Tax and School use. **MONEY BACK GUARANTEED.** Send name and address. Pay postman only \$2.50 plus postage. (Send full cash if outside U.S.) Money back in 10 days if not delighted. **AGENTS WRITE.**

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The Webb Portable Water Softener gives every housewife, soft water in an endless flow for washing dishes, laundry, bath, shampoo and every home purpose. Softens hardest water instantly at the turn of the faucet. Provides healthful drinking water equal to many expensive bottled waters.

Distributors FREE SALES PLAN

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TRIAL OFFER!**

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TOMBSTONES \$9 UP Freight Paid
Genuine Marble & Granite At Low Prices. Lettered. Guaranteed. Free Catalog and samples. Write Us before buying.
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CATCH FISH!

minnows, eels, mink, muskrat, with our folding galvanized Steel Wire Traps. Walton's Automatic Hooks are so constructed that when a fish gives the slightest pull on the bait the upper hook reaches down and gets a hold that lands him. 3 for 60c. Write for descriptive catalog of Traps, Hooks, Lures, and other specialties. **Walton Supply Co., 2567 Junata Ave., St. Louis, Mo.**



Always write your name and full address clearly when answering advertisements.

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Only 50¢**

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POPULAR MECHANICS PRESS
Dept. 240, 200 E. Ontario St., Chicago

2/23/50
(Continued from page 147A)

each with fifteen to forty members. You pay around thirty dollars to join the club and one dollar per week dues. Flying lessons cost approximately five dollars per hour for the period of dual instruction and three dollars per hour for solo time. Since the course may be spread over one year, expenses may be split into weekly or monthly amounts, resulting in the course and club membership costing slightly more than four dollars per week. The second year's expenses per member need not run so high, the individual paying only the dues and the low per-hour fee for using the club's plane. Thus, anyone making twenty to thirty dollars per week might be regarded as able to join such a club and learn to fly.

A flying club may be formed anywhere that ten or more air-minded persons are found. The club may desire to purchase a plane, so the initiation fee for the individual would amount to his share of the down payment. Best results in club work are said to be obtained when a competent pilot is one of the organizers. This pilot instructs the other members in flying, makes up a flight schedule and attends to other duties, for which he receives a small fee from each of the other members. Air-field operators frequently find it desirable to supervise formation of these clubs, since the plan provides a means of keeping one or more ships busy. The initiation fee and dues assure the operator of sufficient income to pay for the plane, which he may use for other work when club members are not flying it.

The second means of becoming a pilot without possessing a large income is by purchasing a secondhand or used lightweight plane. Ships that have been in service from 500 to 800 hours and that are in government-approved condition may be purchased for \$400 to \$700, and up, depending upon the original price.

At the hundreds of large and small air fields scattered over the United States, thousands of persons are learning to fly. One company, the Piper Aircraft corporation, is now training more than 25,000 students, other factories are supervising similar work and flying clubs are adding their "graduates" to the steadily and fast-growing number of private pilots.

Thus, the time when "anyone can fly" seems to have arrived.

SMOKY JOE HAD THE DAMSEL IN DISTRESS!



"GIDDYAP, NAPOLEON! Looks like this Romeo is trying his darndest to smoke us out. Phew! His tobacco smells like the backfire from Pa's flivver!" Just then



UP RIDES A RANGER, sniffs the pipe, says to clean it and refill with *mild* Sir Walter, a burley blend famous for aroma. It worked! Joe won her back!

New!
CELLOPHANE
TAPE around lid

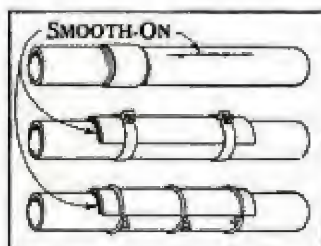
seals flavor in . . .
brings you tobacco
100% factory-fresh!



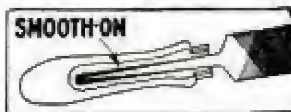
IT SMOKES AS SWEET AS IT SMELLS

TUNE IN—Sir Walter Raleigh "Dog House." Every Tuesday night, coast-to-coast, NBC Red Network.

SMOOTH-ON REPAIRS that save much money!



Stopping leaks at pipe cracks
or joints



Tightening loose
handles



Sealing seams or
punctures in thin
metal



Stopping boiler and
tank leaks

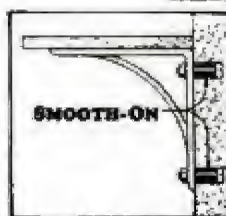
Tightening
loose bolts
or nuts



Resetting
stripped screws



Stopping smoke
leaks



Anchoring in
masonry

Dozens more explained in the SMOOTH-ON HANDBOOK

The instructions, working diagrams and advice in this booklet are a reliable guide in picking out the right Smooth-On composition and application method for many repair jobs. By using Smooth-On you save time and avoid much hard work, and by following the suggestions in this Smooth-On booklet, repair expense can be greatly reduced. Get your copy and keep a can of Smooth-On No. 1 handy.

Buy Smooth-On No. 1 in 7-oz. or 1 or 5-lb. can from your hardware store or from us.

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574 Communipaw Ave.,
Jersey City, N. J.

Please send Smooth-On Repair Book.

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FREE BOOK



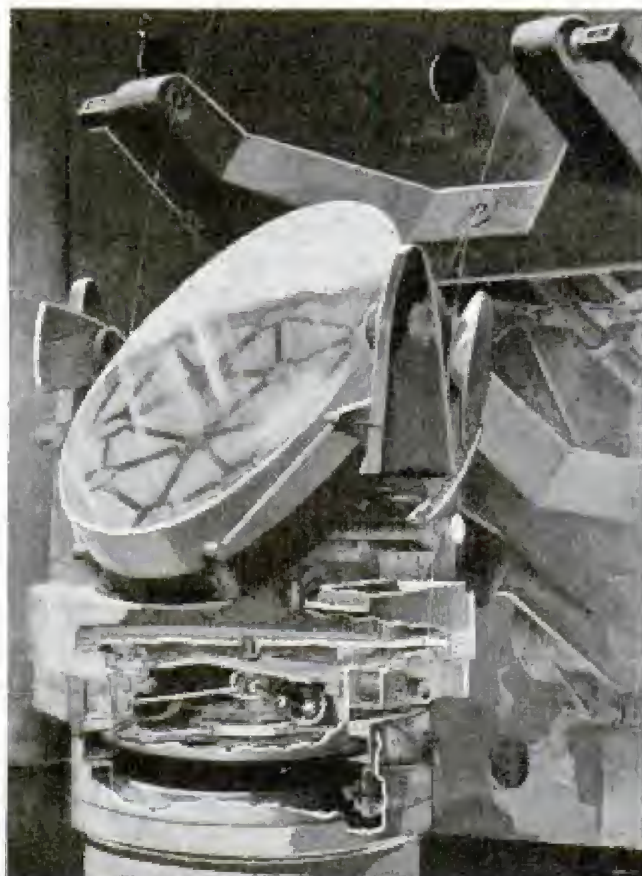
Do it with **SMOOTH-ON**

The Big Eye Takes Shape

(Continued from page 191)

be explained by large detailed drawings prepared by Russell W. Porter of the observatory staff.

The \$6,000,000 which the telescope is costing was donated twelve years ago and at that time the intention was simply to build a telescope that would be twice as large and have four times the light-gathering capacity of the largest existing telescope. But during the last five years many



A Russell W. Porter drawing of mirror placed inside telescope barrel to reflect light gathered by 200-inch mirror out to observing point when special focus that gives high magnification is to be used

improvements have been made. For instance the giant reflecting mirror that gathers and focuses the light is to be coated with aluminum instead of silver, practically doubling its efficiency in the ultra-violet end of the light spectrum.

Will the new telescope supersede the instruments that astronomers are now using? Not at all. It is being constructed to do work that existing telescopes are unable to do. Each big telescope in the world is being used for studying a particular phenomenon of the heavens and the new instrument will be assigned to special tasks outside the ability of the others.

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Waterproof Your Own
Save up to \$100 to \$150

CAPE COD CHAIRS

Style "B", "C", "A", "D". Blueprint 50c. All 4 for \$1.00. **TRELLISES**—12 original designs. Blueprint of all 12 only 50c. **BENCHES**—A beautiful 6' high, 5' 6" long, 2' wide. Blueprint 75c. Send 10c for mailing illustrating many projects. "Over 35,000 Satisfied Customers."

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Costs only \$2.95

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Natural Color Photo Service, Dept. C-54, Janesville, Wis.

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Get Features No Other Power Tools Have

You get the benefit of engineering leadership by buying Boice-Crane... extra strength for the tough jobs; exclusive design controls and gauges to save you time setting up jobs plus split-hair accuracy without fumbling, fussing, or cut-and-try methods; more power efficiency using lower cost, standard, cool running motors.

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From Any Electric Light Socket

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SAMPLES for AGENTS JUST SEND -NAME-

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NU-WAY MFG. COMPANY
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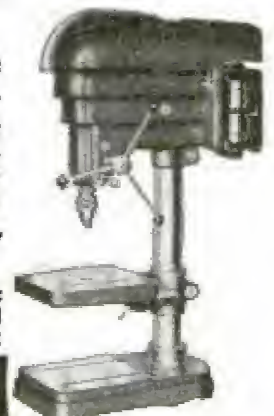
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HOLD**

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PRICES: 24" height for carpenters, etc., \$3.50 per pair
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Instantly changes inches in 10ths to 10ths & half 10ths, or to centimeters & pieces & vice versa. Converts Centigrade to Fahrenheit, or F. to C. Ideal in shop & school, does sq. root, proportion & div. like slide rule. Reverse side is drawing board; handy T-square, Scotch tacks & instructions included. Send 5¢ plus 10¢ postage & handling.
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Automatic Grip Screwdrivers

Hold, start and set-up screws in unhandy places. Gripper instantly released by spring action, sliding up out of way when not in use. Finest materials through, chrome vanadium blades; many have transparent, insulating, unbreakable handles. Models for recessed-head screws. No more expensive than ordinary screwdrivers. At auto-supply, hardware or electrical stores.

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POPULAR MECHANICS PRESS

Dept. 240, 200 East Ontario Street, Chicago

Uncle Sam Helps Himself

(Continued from page 175)

less than one-tenth of the dyes it consumed a quarter of a century ago; even that meager proportion was made from imported intermediates. Now a great organic chemical industry that has come into being is supplying all but a trifling fraction of the country's needs, not alone in dyes but in other fine chemicals. Likewise, it produces needed medicinals in abundance. There no longer is any cause whatsoever for worry over war abroad curbing our supply of drugs.

"When the World War began, the United States was almost wholly dependent upon Germany for potash, which is so essential to agriculture and industry. In recent years methods have been devised for the economic recovery of potash from America's mineral deposits. This country now produces a major part of the potash it consumes. If necessary, it can produce all it needs.

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(Continued to page 160A)



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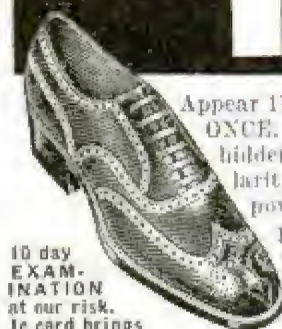
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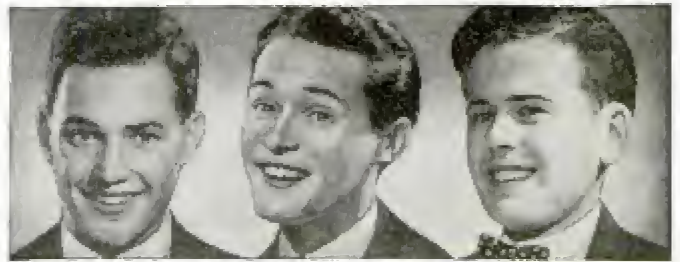
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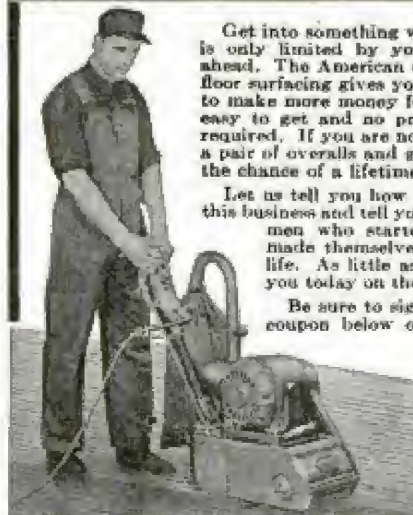
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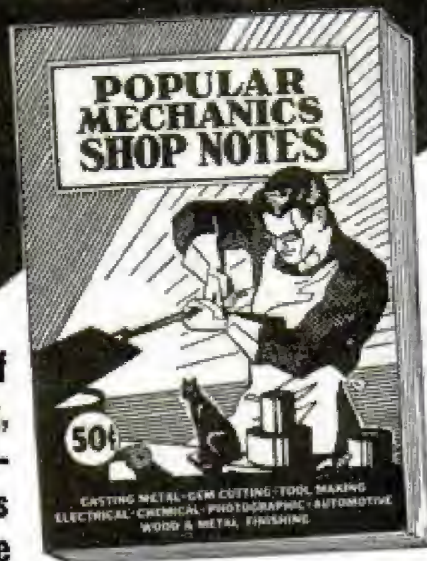


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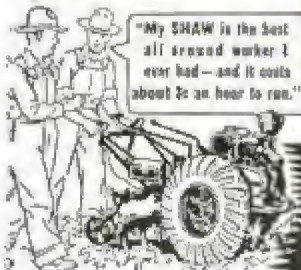
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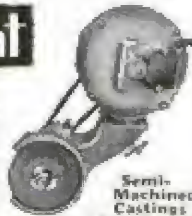
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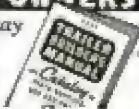


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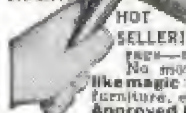
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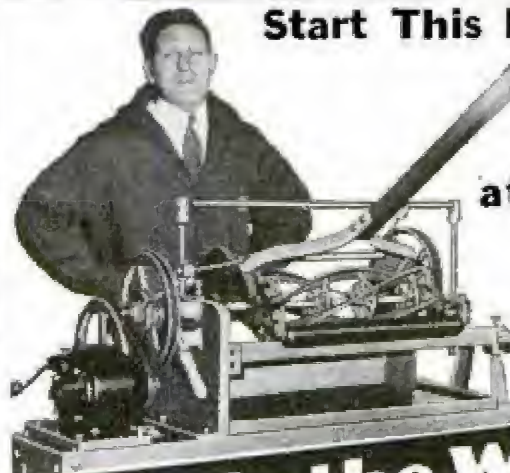
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Complete Set With
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**MONEY BACK
GUARANTEE**

(Continued from page 153A)

“There was no synthetic chemical equivalent for natural bristles in 1914. Today these necessities are being met chemically through nylon, which gives gut for surgical sutures; likewise, bristles better than any taken from the hogs of China or Siberia. Further, nylon within a few months will provide yarn for hosiery, the latest triumph of American chemistry.

“The diversified chemical industry, which did not exist in 1914, is well organized, well equipped, well manned today. It stands as a solid guarantee of American self-sufficiency. Never again will our industrial production which depends upon chemistry be disrupted by wars beyond our shores. Never again will our people be deprived of many vital medicines for the preservation of health.”

Some of the causes for fear in 1914 and reasons for confidence in present-day national self-containment, achieved largely through the accomplishments of chemistry, stand in striking contrast.

American consumption of Chilean nitrates in four of the war years—1915-1918—was nearly 6,000,000 tons. Fifty ships were operated to supply this essential of agriculture, industry and national defense.

The situation in 1914 was critical when five German warships engaged a British squadron in battle off the coast of Chile, sinking a British cruiser and disabling another, and forcing others to flee under cover of darkness. The German ships, however, were destroyed by the British on December 8, off the Falkland Islands. Except for that victory, nitrate shipments from Chile would have been imperiled constantly.

Today, nitrogen fixation plants in West Virginia and Virginia can supply the entire American requirement.

Domestic production of dyes, which were derived from imported intermediates and raw materials, was 6,600,000 pounds in 1914. This was less than ten per cent of consumption. But in 1937, American manufacturers of dyes were producing 122,000,000 pounds. At present, the United States is supplying not only home needs, but has become an exporter of dyestuffs.

The shortage in 1915 was so acute that a quantity of a dye known as Rhodamine B Extra jumped in price from four dollars to \$125 a pound.

Frantic buyers snapped up the dyes cargo of the submarine Deutschland which had slipped into the Baltimore harbor after an amazing voyage from Germany.

The position of users of dyes was accurately stated in a cablegram sent by von Bernstorff, the German Ambassador, to his government, “. . . the stock of dyes in this country (America) is so small that by a German embargo about 4,000,000 American workmen might be thrown out of employment.”

Because of the dearth of blue dyes, our navy was faced with the prospect of crews of “men in white,” and indeed an entire nation in white was the outlook, due to the lack of nearly every color of dyes.

The threatened economic effects could only be guessed. It seemed a virtual certainty that a vast number of persons would be deprived of employment and industrial stagnation appeared imminent. Not only the textile industry was near collapse, but various others including the paper, leather, ink and printing, for without dyes and colors production they eventually would have come to a standstill or nearly so.

There was but one answer—America must have her own dyes industry. Among those which pioneered in the field of domestic dyes production was the du Pont company. Executives of the company already had some experience in the manufacture of coal-tar derivatives. There followed months of experimentation and research, and finally synthetic indigo and sulfur black were perfected and placed upon the market in 1918. Shortly after came acid and chrome colors for wool, direct, developed colors for cotton, and, early in 1919, basic colors.

In addition to dyestuffs, the aim was to produce many of the other organic chemicals essential to home industries. Up to this time, the United States was almost entirely dependent upon foreign sources of supply.

It was necessary to design and construct plants to produce wholly new—for du Pont and the country—lines of manufactures. The money invested was considerable and, as was expected, the losses were heavy. At the end of the first five years, the investment in plants and working capital was \$22,000,000, and there were suffered oper-

(Continued to page 162A)



SAW FILING

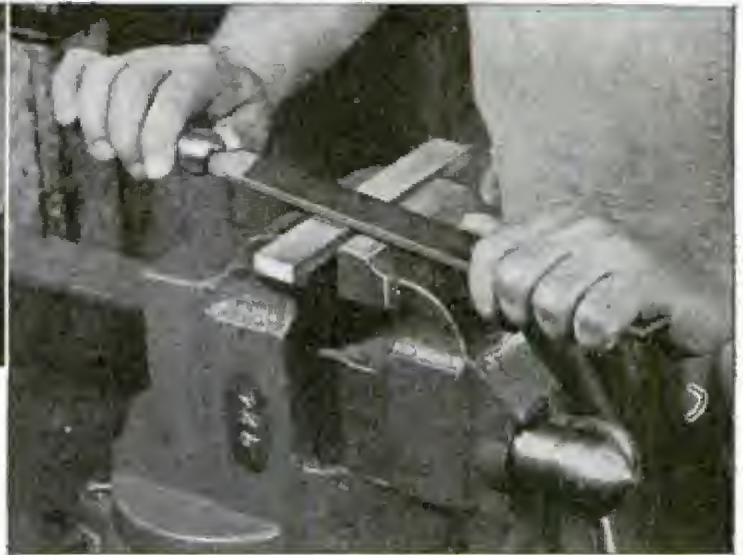
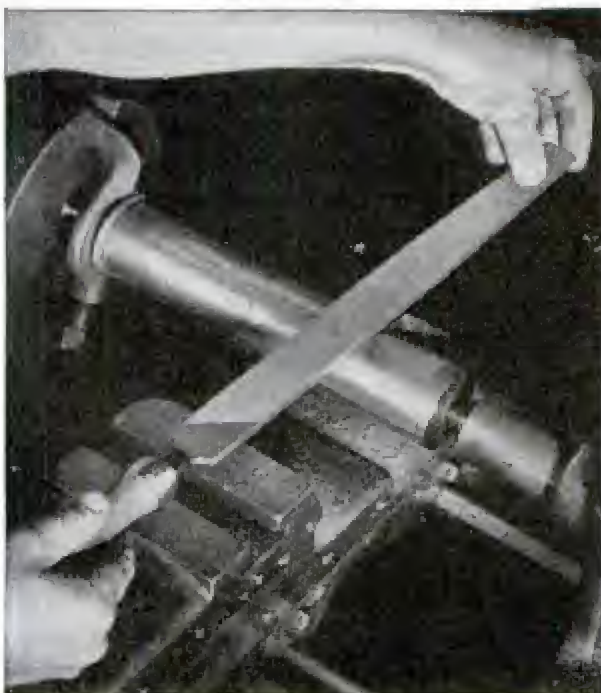
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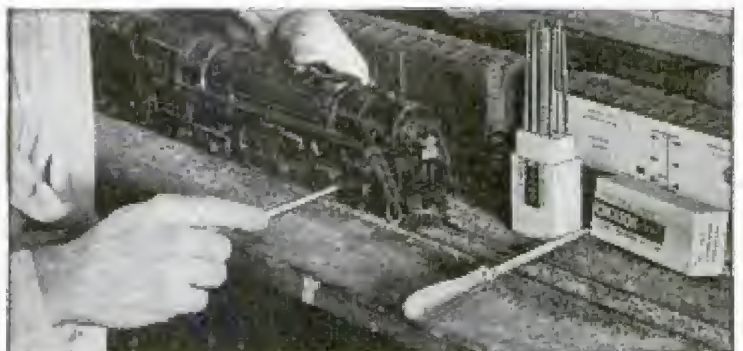
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FEATURES: Weighs under 7 lbs. 45° tilting base for bevels. 4 1/2" blade. Capacity 1 1/4". Depth adjustment. Motor 110 V. universal AC or DC. Runs from light socket. Die-cast aluminum frame. Telescope safety guard protects blade at all angles. Complete with combination saw-blade, ripping guide, cord and plug; ready to use.

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KANSAS CITY SPECIALTIES CO.

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Kansas City, Mo.

(Continued from page 160A)

ating losses of \$18,000,000, a total of \$40,000,000 without a cent of profit during the entire period. But a vital national need had been met.

Early in 1916, agriculture and industry were feeling the pinch of a potash shortage, for imports from Germany had ceased. The little supply available had skyrocketed from forty dollars to above \$400 a ton. Desperate efforts were made to recover the vital element from every possible source, ranging from wood ashes to cement mill dust, yet, even in 1918 only twenty per cent of normal demand—about 55,000 tons—was produced.

Now, with potash consumption at 500,000 tons a year, compared with 200,000 in 1914, the every need for fertilizers and in industrial processes could be provided by potash deposits in Texas and New Mexico, and from Searles Lake in California. The development of our potash resources, extensive deposits of phosphate rock in Florida and Tennessee, and the fixation of nitrogen from the air have combined to enable the United States to become an exporter of fertilizers instead of a helpless importer of two ingredients, as once was the case.

A distressing phase of dependency developed from acute shortages of medicinals of foreign origin. The effect was especially disturbing in relation to such preparations as Salvarsan and Luminal. Aspirin also was among the many German drugs from which we were almost entirely shut off.

Today the situation is so radically changed that anything approaching it could hardly have been dreamed at the time of the inception of America's "Golden Age of Chemistry." In the field of medicinals, it would be decidedly less of a task to list the relatively few which are not produced in this country than to attempt to catalogue those which are produced or those which both have been developed and are being produced here.

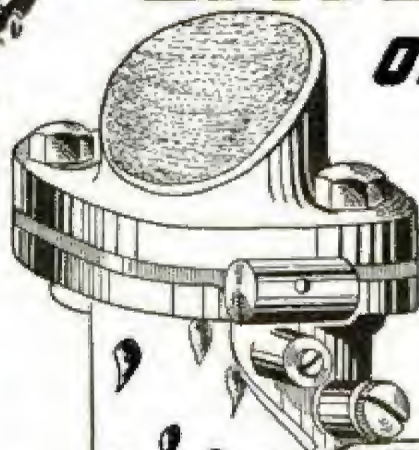
Convincing evidence of our position as a developer and producer is evident in the fact that in 1938 our imports of medicinals and pharmaceutical preparations totaled \$4,328,000, while our exports were worth \$17,079,000.

Truly, America in amazing degree has advanced from its wartime plight of a "have-not" to the greatest "have" nation of the world.



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MYSTERIOUS DISCOVERY
SAVES UP TO 30%
ON GASOLINE!
OR COSTS NOTHING TO TRY



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TRANSCONTINENTAL AUTOMOBILE CHALLENGE
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Dear Sirs:

Having just completed a new speed record between Los Angeles and Chicago, driving a Chevrolet equipped with a Vacu-matic carburetor control, I thought you might be interested in knowing some of the facts and the important part Vacu-matic played in the success of the run.

The distance covered was 3123 miles in thirty-nine hours and forty-two minutes, officially timed by Eastern Union, which gave me an average speed of 59.7 M.P.H. based on elapsed time and with the Vacu-matic averaged 18-1/2 miles per gallon on gasoline.

Before leaving Los Angeles, we made several test runs both with and without the Vacu-matic, and the tests proved that Vacu-matic increased my gas mileage 3-1/2 miles per gallon at the driving speed of 50 M.P.H. and also very noticeable increase in both acceleration and power.

Yours very truly,

Bob McKenzie

In addition to establishing new mileage records on cars in all sections of the country, the Vacu-matic has proven itself on thousands of road tests and on dynamometer tests which duplicate road conditions and record accurate mileage and horse power increases.

You, too, can make a road test with Vacu-matic on your car and prove its worthwhile gas savings to your entire satisfaction.

Learn all about this

remarkable discovery. Get the facts NOW!

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Easy To Install

Vacu-matic is constructed of six parts assembled and fused into one unit, adjusted and sealed at the factory. Nothing to regulate. Any motorist can install in ten minutes. The free offer coupon will bring all the facts. Mail it today!

The Vacu-matic Co.

Wauwatosa, Wis.

Answer this call! Investigate this remarkable discovery that trims dollars off gasoline bills—gives you worthwhile gas savings—more power—greater speed—quicker pickup—faster acceleration. Proven so efficient, it is guaranteed to save up to 30% and give better performance or the trial costs you nothing.

Automatic Supercharge Principle

Vacu-matic is entirely different! It operates on the supercharge principle by automatically adding a charge of extra oxygen, drawn free from the outer air, into the heart of the gas mixture. It is entirely automatic and allows the motor to "breathe" at the correct time, opening and closing automatically as required to save dollars on gas costs.

Sworn Proof of Gas Savings

This certifies that I have carefully read 300 original letters received from Vacu-matic users testifying to gas savings up to 30%, many reporting added power, smoother running, and quicker pick-up. These letters are just a small part of the larger file of enthusiastic user letters that I saw at the company offices.



Signed *Marcus J. Plaut*
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Everybody—even grumpy old Chief Eaglebeak—is mighty excited over Mead's big, new 14-foot portable Outboard KI-YAK! Think of it!—ANYONE, without previous experience, can build OK-4 at home in a few evenings and save nearly **HALF** the factory-built cost—or sell to others at Big Profit! And get these startling OK-4 features: Carries 4 adults comfortably, and duffle—takes motors 9 h.p. or less, oars and sail—weighs only about 75 pounds for easy portability on shoulder or car-top for fishing, camping, touring, hunting. Seaworthy. Leakproof. Durable. Double canvas bottom for double-safety! The biggest, lightest, strongest boat of its kind—AND—made only by MEAD—in knock-down kits for quick home-assembly, or factory-built, ready for the water. Rush time for Chief Eaglebeak's big illustrated Circular, amazing Low Factory-To-You Prices! Oars and oarlocks now INCLUDED with your OK-4 Kit . . . hurry!



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